INDUSTRIAL ARTS and VOCATIONAL EDUCATION

February, 1939
Vol. 28, No. 2

PUBLISHED MONTHLY, EXCEPT DURING JULY AND AUGUST, BY THE BRUCE PUBLISHING COMPANY, 524–544 NORTH MILWAUKEE STREET, MILWAUKEE, WISCONSIN

Eastern Office: 330 W. 42nd St., New York, N. Y. — Western Office: 66 E. South Water St., Chicago, Ill.

CONTENTS

Aims and Types of Industrial Education, *by Homer J. Smith* 45
Contributions of Drafting to the Complete Education of Youth, *by A. K. Rigast* 47
If You Bristle While You Work, *by Hyman Goldstein* 50
Juvenile Delinquency and Vocational Education, *by William H. Dooley* 52
Evolution of Our Alphabet, *by Harvey W. Waffle* 54
History of Woodworking Machinery, *by John H. Carr* 58
Predicting Trade-School Success — V, *by Joseph W. Fleming* 62
Analysis of Technical Content in Upholstering (Chart), *by Herbert Bast* 66
Editorial 69

Testing and Tests

Test in Electricity, *by T. L. Stanaway* 71
Broadening the Use of Tests, *by O. L. Young* 71
General Metalwork Tools Test, *by G. L. Simnicht* 72
Wood-Finishing Examination, *by Herbert K. Iverson* 72

Problems and Projects

Handy Rack for Hot Soldering Coppers, *by Eugene W. Frank* 73
Solving the Sandpaper Problem, *by R. L. Grandle* 73
Block Cuts of Famous People, *by May L. Lampe* 74
Switchboard for Studying Parallel Circuits, *by G. S. Ketiladze* 75
A Handy Bit Gauge, *by C. E. Beck* 75
Making Marionette Animals, *by Helen M. Douglas* 75
Cuff-Button or Jewelry Tray, *by Osma Couch Gallinger* 77
Scroll Candlestick, *by Leon H. Baxter* 78
Auto Horse, *by Isaac R. Taylor* 78
Apparatus for Demonstrating Line-Drop and Power-Loss Problems, *by G. Lewis Parsons* 79
Folding Metal Book Ends, *by L. C. Peterson* 80
Key Plate, *by Edmund Schulte* 81
False Faces and Masks, *by W. Ben Hunt* 82
End or Side Table, *by Floyd Keith and J. E. Ray* 82
The Mortise-and-Tenon Joint — XI, *by John E. Doren* 86
Soap Container, *by Harry W. Kroll* 13A

Personal News 13A
New Publications 13A
Association News 14A
News Notes 17A
New Products 17A
New Trade Catalogs 19A
Trade News 19A

IN THIS ISSUE

The February number of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION brings to its readers a number of important articles. Among these are the following: *Aims and Types of Industrial Education*, by Homer J. Smith; *If You Bristle While You Work*, by Hyman Goldstein; *Juvenile Delinquency and Vocational Education*, by William H. Dooley, and a continuation of Joseph W. Fleming's article, *Predicting Trade-School Success*.

Teachers of drafting will find *Contribution of Drafting to the Complete Education of Youth* and *Evolution of Our Alphabet* very interesting.

Woodworking teachers will find the following helpful: *History of Woodworking Machinery, Analysis of Technical Content in Upholstering, Broadening the Use of Tests, Wood-Finishing Examination, Solving the Sandpaper Problem, A Handy Bit Gauge*, and *The Mortise-and-Tenon Joint*.

For the instructors interested in electricity there are *A Test in Electricity, Switchboard for Studying Parallel Circuits*, and *Apparatus for Demonstrating Line-Drop and Power-Loss Problems*.

For the metalwork teachers the following are offered: *General Metalwork Tool Test, Handy Rack for Hot Soldering Coppers, Scroll Candlestick*, the *Auto Horse, Folding Metal Book Ends, Key Plate*, and the *End or Side Table*.

Printers will find the article on *Block Cuts of Famous People* quite helpful, and teachers of general handicraft work will find interest in the articles on *Making Marionette Animals, Cuff-Button or Jewelry Tray*, and *False Faces and Masks*.

OUR NEXT ISSUE

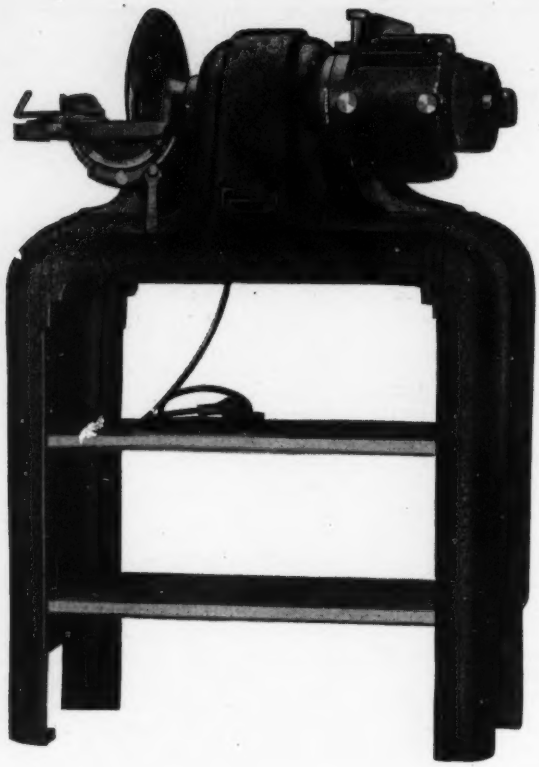
The March issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION will again bring to our readers the special issue known as *Bruce's School Shop Annual*. This particular number will be replete with helpful material on school shop planning, budgeting, and equipping. There will also be course outlines, hints on shop management, and other matters of interest to teachers, supervisors, and directors of industrial arts and vocational education.

MARCH CONVENTIONS

March 9–11 Southeastern Arts Association, Birmingham, Ala.
March 16–18 New Jersey Vocational and Arts Association, Ashbury Park, N. J.
March 23–25 Texas Vocational Teachers Association, Houston, Tex.
March 31–April 1 Indiana Industrial Education Association, South Bend, Ind.

Articles Indexed — The articles contained in the Magazine are regularly indexed in "The Readers' Guide to Periodical Literature," and "Education Index."
Entered Jan. 2, 1914, as second-class mail matter at Milwaukee, Wis., under Act of March 3, 1879. Copyright 1939, by the Bruce Publishing Co. Title registered as Trade Mark in U. S. Patent Office, Nov. 25, 1930. Published monthly except during July and August.
Subscription Information — Subscription price, $2.50 per year, payable in advance. Canadian postage, 25 cents, foreign countries, 50 cents. Copies not over three months old, 35 cents; more than three months, 50 cents. Notice for discontinuance of subscriptions must reach Publication Office in Milwaukee, at least fifteen days before date of expiration. Changes of address should invariably include old as well as new address. Complaint of nonreceipt of subscribers' copies cannot be honored unless made within fifteen days after date of issue.
Editorial Contributions — The Editor invites contributions bearing upon Industrial Arts, Vocational Education, and related subjects. Manuscripts, drawings, projects, news, etc., should be sent to the Publication Office in Milwaukee. Contributions are paid for at regular space rates. In all cases manuscripts should be accompanied by full return postage.
The Magazine is on sale at Brentano's, New York; Wanamaker's, Philadelphia; Brentano's, Chicago; Phillippine Education Co., Manila, P. I.

W-90, W-95 SANDER



If preferred, the belt sander or disc sander can be mounted in combination with the Yates-American W-80 Grinder, a sturdily built machine designed to resist heavy shock loads. It is completely guarded and is equipped with a laminated safety glass eye shield. A built-in dust chute and water well are provided. Either of these combinations is well within the limits of the average school budget. Write for more information now!

YATES-AMERICAN MACHINE COMPANY • BELOIT, WISCONSIN

This is the fourth of a series of brief articles dealing with various woods, their properties and uses. It is our hope that they might make interesting and helpful classroom material. We will welcome your suggestions as to the species of wood you would like featured in this series.

YATES-AMERICAN

School shop instructors are keen and critical judges of equipment values! They know that *any* machine will not do for school use, because student operation often imposes severe demands not encountered in other fields. That's why we are confident that school men recognize how well this combination sander fits into the school picture.

The belt sander produces a professional finish on wood, metal, fibre, plastics and ceramics. The ends of the table conform to the shape of the rolls, and eliminate the usual wide gap between the table and rolls. Adjustments are easy to make. Front roll is well cushioned with rubber for sanding curved surfaces. A dust hood disposes dust conveniently.

The disc sander is invaluable in producing strong, well-fitted joints. The heavy, cast-iron table is supported on two strong trunnions and can be tilted 45° either way. It is cross-slotted, allowing the mitre gauge to be used in two directions. The nickel-alloy cast-iron disc runs flat and true. Self-generated air currents carry off dust through a built-in dust chute.

SHORT TALKS ON WOOD

SUGAR MAPLE (*Acer saccharum*)

Probably the best known American hardwood because of its timber and sugar products and wide use as a shade tree. The wood is reddish brown, heavy, hard, even-grained, and easy to work. Curly and bird's-eye maple, caused by abnormal growth, are prized in cabinet making. Capable of a fine polish.

Known commercially as hard maple, it is used in the manufacture of flooring, furniture, woodenware, interior finish, tool handles and many other articles of commerce. The sap yields maple sugar and maple syrup.

Occurs in every state east of the Mississippi although relatively rare in the South. Prefers moist soils of the lowlands or slopes.

A large tree attaining heights of 60-100 feet and diameters of 3 feet or more. In the open it usually has a short trunk and dense, symmetrical crown. In the forest the trunk is often without branches for a considerable distance, and the top is short and spreading.

The bark on old trees is dark gray and broken into long flakes or scales. On young trees it is light gray and smooth. The leaves are simple, opposite, from 3 to 5 inches long, coarsely toothed, dark green above, pale green with silver cast below. The fruit is a pair of winged seeds often called a "key". The wings are about an inch long, and almost parallel to each other.

INDUSTRIAL ARTS and VOCATIONAL EDUCATION

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Aims and Types of Industrial Education

Homer J. Smith

Professor of Industrial Education, University of Minnesota, Minneapolis, Minnesota

A paper read at Atlantic City, March 1, 1938, before the American Association of School Administrators.

If the assignment has been correctly understood, I am to speak about industrial education in a sketchy way, from the viewpoint of administration, and with particular reference to types of classes and schools. We cannot here consider course content, methods of instruction, equipment, class management, product, and similar details. They are interesting in themselves and are the conditioners of effective industrial instruction. Moreover, many of these details are true innovations in educational procedure, with high transfer value for other specialties and for the more constant subjects of the program.

For appropriate suggestions on these specifics any administrator must depend upon his special instructors and overseers. This need of dependence accelerates through the years, as the field involves an increasing percentage of the personnel, as it is subject to more insistent demand, and as it reaches out to more citizens, young and old, with its service. Perhaps no curriculum area has changed more in the past decade in attempt to meet pupil needs and to match the shifting requirements of employment. Perhaps no other area has produced a greater amount of literature based upon new practice nor shown more improvement in the courses and activities of the teacher-training centers. Industrial education is an active field of constantly widening scope and changing perspective. Administrators cannot be expected to help us much on the *hows* of our work, but they can and must understand and control the *whats* of our work in keeping with the *whys*. Aims and types of industrial education are squarely within the province of the administrator.

A five-foot shelf could be filled to overflowing with our printed statement concerning aims, objectives, and purposes in this field. We have written about the usefulness of separate industrial subjects, of departments, of types of shops, and of kinds of schools. We have considered the aims of pupils, of teachers, of industry, and of the several levels of achievement. We have tried to sense the correct thing to do for all of the individuals under our care, in whatever pattern of school organization. We have been sensitive to purposes and partial to individuals.

Individual or Group

It seems to me that in the whole realm of education, including industrial education, we are placing too much emphasis upon the individual. *This is a world of groups* — groups racial, religious, political, economic, and social. For purposes of this discussion it is a world of groups educational and occupational. Many professional and business types in our society render their services in terms of *groups*, meeting in secondary fashion the variations among individuals within the groups. It would seem that educational planning should place more emphasis upon group needs and group potentialities. We have some notable examples of such statesmanship and we are making some progress, generally, in this direction. But, on the whole, we are strenuously engaged in studying individuals, in giving them school adjustment as individuals, in perfecting instructional materials for them as individuals. We seem to overlook the needs and possibilities of the groups which these individuals comprise. Your city — the state and nation and world, shrinking every day — is a curious mixture of groups of people with rather similar characteristics. If administrators will recognize these groups and, by surveys learn their wants and needs, we may leave to the teachers the task of providing such slightly different treatments as may be required by certain individuals within the groups. Here is the difference between directing an army and working closely with a squad.

The important question, when a new subject is proposed is — what groups will it serve and to what extent? When a new department or a separate school is to be inaugurated the query is the same and the decision should there rest — what group or groups will it serve and how long and how well will it serve them? The curriculum of any school, large or small, may well be based upon the studied requirements of the groups of youth or adults within the district or within the ever widening community that should become the district. When training facilities are contemplated, when guidance activities are planned, when placement and follow-up programs are instituted, the factor of chief influence is the presence of groups. This is why educational offerings and practices must be dissimilar throughout the nation. This is why no state should devise a standard pattern of industrial education, general or vocational. This is why the remaining pages of this paper do not provide a specific program that any administrator may adopt for his home situation.

There are two complementary phases or kinds of industrial education — the general or industrial-arts phase and the strictly vocational or training phase. These should be thought of, not as mutually exclusive and different offerings, but as closely allied and interdependent parts of a complete service. Students, teachers, equipments, and moneys in these two phases need administrative attention in the direction of welding and fusion. The early federal-aid practices tended to hold them apart which, I think, was well advised in the beginning. For the years ahead a closer union of the two seems not only a wiser course but a plan in process of realization. Ultimately we shall have more state and more federal aid for this work in support of well-founded programs without regard to their constituent elements. The criteria for aid will be goodness of concept, worthiness of effort, and effectiveness of placement and adjustment result. It will be a matter of service rendered to existing, needy groups. There will be lateral and vertical integration.

Need for Self-Expression

It may be said that all elementary pupils, both boys and girls, need some form of industrial instruction for self-expression, the joy of doing, the clarification of other subjects, and the development of traits

such as exactness, economy, and perseverance. These manipulative and informative lessons and practice periods match the natural urges of children to construct, to compete, and to co-operate. They later provide planning and reasoning experiences and aid youth to understand the physical environment, to appreciate the problems of workers, to develop talents and occupational attractions. If we think of the elementary school as closing with the sixth grade, we may think of the whole institution as the first and universal group for which industrial provision should be made. How much of this teaching should be attempted by the regular teachers in their classrooms, how much through activity rooms and clubs, and how much with special shops and instructors is a matter of varied administration. Certain it is that pupil satisfaction, broader social intelligence, consumer appreciation, and work attitude are ideals possible of approach at this early age.

The Guidance Function

Most of the pupils who continue in the junior and senior grades will have need for more detailed instruction, not necessarily the same for all. They will need general guidance through the introduction of more media, more processes, and more of the informational element. Some secondary groups may well pursue industrial subjects throughout their full stay, beginning with scatter or extension and closing with intensive learning in one selected field. Some groups may well be excused. Others should be given industrial subjects most fitting their college or professional intentions. At this same age level there are likely to be low mental groups, physically handicapped groups, and early leaving groups. It is logical, also, that we give particular assistance to agricultural, homemaking, commerical, or art divisions. Whatever is done for these high-school groups cannot be made too practical or functional. If courses for some of them are made strictly vocational, even involving federal funds, we shall be wholly within the American concept of secondary practice. As to the basic right of a boy or girl to specific trade preparation in a cosmopolitan, coeducational high school there can be no question.

If we are to have a democratic system, the secondary school and the junior college, now so frequently included, must help us to bring it about. It is neither educationally, socially, nor economically sound to restrict preparation for industrial and commercial pursuits to special schools and to urban centers. Vocational preparation must be afforded geographical scatter by every means that we can devise. It must be made *freely* available to our young people as well as to those who will offer them employment. It must be made *conveniently* available so that there may be realness and timing and supply control in the process.

We need part-time classes and relationships for some young-worker groups, co-operative half-time arrangements for other groups, and full-day or half-day preparatory courses for still other groups. Small high schools may co-operate in the use of itinerant teachers and, better still, in the use of itinerant libraries and equipments. We need more local vocational directors, more co-ordinators and more guidance, placement, and follow-up workers. We need these in connection with the high schools and junior colleges and we need them twelve months of the year. In fact we could make excellent use of all of our vocational and practical-arts teachers on a full-year basis. We need a longer day in our high schools, a more flexible teacher schedule, some instructors of practical trade experience, a closer contact with a greater variety of employers, and a vice-principal vocationally trained. In some way, in different ways in different districts, we must provide more terminal courses after fundamental studies of group needs and employment possibilities.

We must serve the full-time pupils, the part-time pupils, the graduates out of work, the young apprentices, and the young full-time workers. Here we have secondary-education problems and responsibilities. This service to groups should be close and co-operative and continuous throughout the year. Indeed, I favor supervision of the vacation employments of those pupils who work in summer so that these brief earning periods may be in the nature of proving experiences. If we do our best through nine or ten months to help youth find their places in life and to become prepared for them, it would seem logical that they should help us during the other two or three months in our efforts for their welfare. Supervision of summer employment might provide more jobs and it certainly would assure us some guidance and training gains among those who were employed. A student's vacation, if he works for pay, should contribute to his occupational choice and preparation.

With such types of classes and such services as have been mentioned we can place vocational opportunity near the homes of our secondary pupils. Later we can supplement these arrangements with state schools, district training camps, supervised correspondence courses, extension classes, co-operative placement agencies, and factual employment researches. We can do all of these in the name of public, secondary education.

The Need for Industrial Education

Let us not assume that the advance of machine production lessens or obviates the need of trade and technical schools in the great cities. Increasing demand for instruction, bulging shops and classrooms, and the hundreds of thousands turned away are sufficient answer to this question. More theoretical, but just as valid, answers are that the machine does not necessarily cause unemployment and that the majority of industrial workers are not serving where machines are employed or are likely to be employed to the point of distress. Neither should we assume that training programs within the industries themselves can decrease our responsibility. The demand for training is unbelievably great, once we listen for it; and it is unbelievably diversified, once we find it and seek to supply it. We cannot have too many agencies — public, private, corporation, and endowed — taking part in this work, if they will make reasonable division of it and co-operate with good spirit in doing it. Public sponsorship of vocational training at the secondary level is a clear goal or duty, and wider geographic scatter of it is both a dire need and a wise policy. The secondary school has long felt that it *shouldn't* or *couldn't* help in this work; it is now taking a *can* and *will* attitude, even in the smallest places. The junior college has a responsibility in this connection that has not been sensed in any worthy measure. The opportunity for creative administrative thinking at the junior-college level is limitless. In view of its primary function the junior college is unfortunate in its name; it is circumscribed and inhibited by it. It should serve largely in terminal pattern for the young people and for some of their parents.

Industrial Education and the Adult

Perhaps the greatest need of industrial education is presented by the normally employed adults — the millions of middle-aged men and women who toil in perplexity and uncertainty and who may be served through evening and extra courses. It need not be argued here that work types wane and die and that new ones are constantly born. It need not be shown here that materials and processes change in a way to baffle employers and workmen alike. Constant employment, on the part of an individual or a firm, is largely a matter of adjustment.

Heads of families, responsible adults, although constituting an enormous army, must be looked upon in breakup or division — must be considered as groups of different and of changing needs. Many adults who are dedicated to nonindustrial pursuits desire industrial courses of the hobby and recreational kind. Their right to this form of leisure activity, under the guidance and help of our trained personnel, with or without school credit, cannot be questioned. We shall do well to recognize and to encourage the ambitions of these nonindustrial patrons.

Some adults need basic training for work fields in industry not yet attempted. Some need retraining because fields or jobs have evaporated or are showing unmistakable signs of decay. Millions need constant upgrading in the trades of their choice in order to remain competent and worthy of retention. Still others need marginal preparation within their fields so that employers may shift them, as the months pass, the better to meet the peak-and-valley conditions within single firms. As technological

advances are made and as cyclical changes occur, our adult workers will continue to face us as needy and hopeful groups. We owe them a constant service, a service assumed to be varied, a service which shows results and fosters their respect for their schools. The continued adjustment of our employed adults is a national problem of major importance; it is a matter for widespread state planning; it is a responsibility of local districts or units, however small. Every school system must make some contribution based upon close and everlasting study of its own people and its own facilities.

In closing, let us review briefly, and with some omission, the types of instruction suggested. Each of the following terms or expressions has a history and a technical connotation in current practice. These are some of our catchwords; they sample and indicate our planning philosophy: Industrial arts, general shopwork, activities room, household mechanics, farm shopwork, opportunity room, industrial club, home workshop, girls' classes. And, again day, evening, and part-time schools, cooperative half-time agreements, supervised apprenticeship, shop, related, and nonvocational subjects, dull-season courses, itinerant instructors, and foremanship conferences.

With these and other conveniences we are a quarter century on our way in a useful and necessary service. We are on our way in a field representative of the greatest total of people gainfully employed. Industrial education permits of great variety, not alone of types of schools and classes, but of basic personal and group contributions. It affords acquaintance, exploration, preparation, upgrading, retraining, and marginal facility. It provides recreational outlet for some and furnishes sorely needed and salable skills for others. It offers useful knowledge, cultural appreciation, and worthy work interests and attitudes. Industrial education helps to solve the home problems as well as the shop problems of workers. It is good sociology and good economics as well as good education.

All of these possible gains are in process of realization to some degree in your several towns and systems. The task ahead is one of extension and perfection of these beginnings. Let us not neglect the girls and women. Let us recognize natural desires as well as economic necessities. Let us serve adults as well as children. Let us do related work, at least, when we cannot arrange shop classes. Let us deal with the social as well as the technical problems of workers. Let us realize that even the smallest district can function in some way. Above all, let us study our people, young and old, in school and out, in terms of groups. Let us learn their difficulties and heighten their morale; let us supply their needs and safeguard their work span and old-age securities. There is no individual who cannot profit by some form of industrial instruction. There are innumerable groups who cannot "carry on" without this help. The problem varies as the school or community. Your program may well be anything, old or new in the practice of this special field, if it meets your special circumstances — if it serves your special groups.

Contributions of Drafting to the Complete Education of Youth

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An evaluation of what drafting offers educationally both from the vocational and nonvocational viewpoints.

The modern school, according to Dewey and Kilpatrick, should lay less stress upon the acquisition of knowledge for its own sake, and should place a new emphasis upon the mastery of knowledge, development of skills, and the formation of desirable personal and social responsibilities, ideas and ideals for the sake of more adequate and richer living of the individual in a social group. The subject is only a means to an end which is the growth and development of the child. The subject is of value only as it contributes to the realization of these objectives. The child thus becomes the focal point toward which all the different subjects taught should converge. It is futile to teach the principles of social living in a separate course. Unless all subjects teach the ideals of collective living, our individual and separate efforts will amount to little. The same may be said of many other desirable qualities and attitudes — *health*, for instance, esthetic reactions, and so on.

It is obvious that the school must become a co-operative enterprise in which all the active members should strive collectively and co-operatively, consciously and definitely toward the realization of the common goal; namely, the development in the students of all those qualities and attitudes which will enable them to live adequately, richly, and efficiently in a social group. In brief, plasticity of mind, effective skills, social consciousness, vigorous and sensitive personality are the objectives of modern education.

The Contribution Made by Drafting

What does drafting contribute to the complete education of youth, and how does it fit in the picture of the new educational philosophy of child growth and dynamic living?

It is believed by many educators that drafting is primarily and solely a skill or manual subject, and as such it has been kept in the curriculum ever since it was introduced in our schools. Due to this misconception, this important subject has always occupied one of the bottom rungs of the educational ladder. To assert that it could be one of the very best means for the training of the mind would be tantamount to an educational heresy in the eyes of many orthodox educators. Yet, it is true that drafting does possess a duality of character: Thinking and doing — "the doing growing out of thinking, and the thinking made clear and definite through the doing."

The Reasoning Process in Drafting

Drafting in its essence is an analytic-synthetic procedure. The thought process must always follow a definite and sequential order. The *very first* step the student must take is the analysis of the problem into its component parts; he studies each part carefully, and closely observes each detail; he collects all the facts bearing upon the problem in hand, and arranges them in their proper sequence. This step presupposes a great deal of factual knowledge, such as the principles of projection, as well as the meaning of every symbol, line, and figure. This analysis is obviously an intense mental process, and must take place before a stroke is made on the paper. The *second* step is the formulation of specific conclusions from these facts as to the correct method of procedure in the solution of the problem. In this step, the synthesis is completed, and the student is now ready to apply the knowledge gained in the first two steps. The actual drawing

or application, therefore, is the *third* and final step in this thought process.

The student in drafting must invariably follow these three steps: Observation, reflection, and application or execution. The hand cannot be trained before definite and clear concepts have first been formed. Muscular activity begins only after the mental processes have been completed. Only thus a complete co-ordination between the mind, the eye, and the hand can be established and maintained. It is folly to talk of the training of the hand without taking into consideration the role the mind plays in this training process. It is what takes place in the brain that gives drafting its greatest value.

It is obvious that drafting, when properly taught, develops clear and definite concepts, stimulates exact thinking, and forcefully demonstrates to the student the need for systematic methods of procedure in the solution of a problem.

Drafting Trains the Power of Visualization and Constructive Imagination

Drafting also develops the ability to visualize *size* and *shape*. Every teacher of this subject has undoubtedly observed that beginner's concepts of shape and size are relatively meager, unstable, and lack vividness and veracity. Hardly any student is able to lay off one eighth or one sixteenth of an inch without measuring it first. It is difficult for many students in the beginning to visualize small unit-measures. Presumably the same is true of large measure-concepts. This deficiency does not necessarily indicate low mental levels of these students. They have never been given any opportunity in school to acquire these special and vitally necessary experiences. How can anybody go through life successfully with inadequate measure-concepts, since everything is being measured in one form or another?

Drafting is unquestionably one of those school subjects which, in its very nature, involves size delimitation. Every line, every figure, as well as every letter and symbol is drawn to an accurate and definite scale. It is interesting to observe how rapidly students form and develop these size concepts, and their evolution is not a transitory or a fading-out process, but, once formed, those concepts continue to grow in scope and exactness in or out of school.

Drafting is also an exact science of form description. However simple the graphic representation of an object may be, the form or shape of it must be clearly and accurately described.

All objects are perceived in a three-dimensional form: length, width, and thickness. Without thickness or depth all objects would appear flat. Objects, therefore, do not appear to us as they actually are, but only in apparently true form and size. In order to describe an object accurately, the principles of projection must be used. Drafting, therefore, is the only subject by which the ability to translate one's three-dimensional pictorial concepts of objects to one plane of two dimensions can be trained and extensively developed.

This process to see a three-dimensional object one moment, and then resolve it into two-dimensional views the next, is difficult for the student to grasp without training. He cannot at once grasp the relation between these flat planes or views and the object which they represent. This inability to see the object when he is looking at the orthographic views is due to the fact that he has not learned as yet to synthesize the different views in one pictorial concept of three dimensions. In other words, his mind has not been trained to run like a shuttle between analysis and synthesis. To be sure, some students are more visually minded than others, nevertheless all can be trained, so that eventually they learn to visualize with great detail and accuracy the form and size of even large and relatively complex objects.

This power to visualize and to imagine objects and project them into space is of inestimable value to the future builder, designer, engineer, or architect, because any object or any structure must be constructively imagined and visualized first before it can be planned on paper, whether the object be small and simple, or vast and complex.

To the creation and development of this power — visualization and constructive imagination — drafting makes a unique and significant contribution.

There are unquestionably great ethical values inherent in drafting, because every stroke, every line is visible, definite, purposeful, and performed in orderly manner. There can be no scattering of attention or flight of fancy, for the drawing will reveal forcefully, black on white, poor judgment, indifferent planning, and slack performance. The method of work must always follow a sequential order: observation, reflection, and action or execution. The student may not act and then observe, for the results will invariably be poor. There is no possibility for "bluffing" — the results are either good or bad, accurate or inaccurate.

It is quite obvious that drafting lends itself readily to the formation of right social habits, such as neatness, accuracy, careful observation, and logical planning of work. If the plate is dirty, smudgy, and is passed by the instructor, the effect upon the student's moral nature will be negative. If the work is inaccurate, and is not carefully checked by the teacher, the student will persist in his slovenly habits, and the school has failed in its educative function. If the proper methods of work are not carefully observed, the student will flounder around, and inefficiency will result — a very undesirable trait in present industrial civilization. If the work is not carefully planned, the result will lack harmony and unity, and the student will persist in acting first, and thinking afterwards. In brief a drawing, when finished, is either right or wrong, never both. If wrong, the result will cause disagreeable consequences; if right, the result will be a source of pleasure, satisfaction, and growth in personal character.

The Sense of Achievement

A few more touches here and there with the cleaning eraser, and the drawing is finished; but before he hands it in, Jack surveys it once more critically for any inaccuracies and omissions. He is pleased with it — the lines are clean cut, and their differentiation carried out to perfection; the different views are symmetrically grouped around their proper axes, and the lettering is craftsmanlike. The whole drawing has the appearance of a perfectly finished product.

Jack shows it proudly to his neighbor who enthusiastically exclaims: "What a fine drawing you have finished there, Jack!"

This imaginary scene can be observed almost daily in the school drafting room. What are the student's reactions when an especially good piece of work is turned out by him? Is it a feeling of achievement, an appreciation of values, or a subconscious esthetic reaction to something beautiful? Obviously all of these factors are involved in this emotional complex. Drafting, in the course of its development, has become a strictly utilitarian subject in the eyes of many teachers, a subject whose purpose is merely the graphic representation of an object of use. To see beauty in a drawing produced by mechanical means would appear to many as an attempt to prove the reality of something nonexisting. Our concepts of the beautiful have been severely delimited by the notion that esthetic values are inherent only in works of art, painting, sculpture, music, and the like. It is not generally recognized that everything is of relative value, and is a matter of degree only. Whether one thing has greater or less esthetic value depends upon the fine sensibilities of the person concerned.

Teachers of drafting must extend this conception of the beautiful, and endeavor

to perceive lasting esthetic values in a well-executed mechanical-drawing plate. They must also stress the development of the proper emotional nature of their pupils. If drafting is used as a means to that end, it is unquestionably rendering a real social service to youth.

But how can the esthetic sense be developed in students by means of mechanical drawing? Are not lines the elements which the student-draftsman uses in space delimitation? These space-binders are a few in number, the horizontal, the vertical, the oblique, and the curved or circular. Through human sensibilities they have acquired human significance to a large extent. By means of these four fundamental lines definite moods or emotional effects can be attained. Horizontal lines produce the mood of quiet and rest; vertical lines convey the feeling of awe and reverence, as in tall trees, or a gothic spire; curved lines are soft, delicate, and produce the feeling of gentle, rhythmical motion, as well as that of peace and contentment. The dramatic emotion is expressed by diagonal or oblique lines, as in slanting rain, lightning, and bending trees.

The artist uses these fundamental lines to produce different moods. Is it not safe to assume that they also produce the same effect upon the esthetic nature of the student, perhaps in lesser degree and in subtler manner, since he also uses these primary lines in his daily work? A well-executed line releases in us a very definite emotional response. If the lines are beautiful, the result is a good-looking drawing, and the observer derives a great deal of pleasure from looking at it because the eye glides over it easily and rhythmically. We exclaim when we are confronted by an exceptionally good drawing: "What a fine piece of work!" Is not the student affected the same way? Casual observation of the pupil's reactions will prove that he also is susceptible to the effects of the beautiful.

Whether drafting possesses any esthetic value, depends upon the execution of the drawing. If the lines are not clean cut, expressive, and significant, if the lettering is poor, and the views are not balanced, or are unsymmetrically grouped, and the general appearance of the plate is messy and smudgy, then the effect of such a drawing upon the pupil is not merely neutral, it is negative, for it degrades and vitiates the esthetic sense, and may tend to deaden the nobler spiritual emotions of the student.

Nonvocational Drafting

It is safe to say that many students who take drafting in school will never have any direct use for it. Many will choose occupations which will not require any practical application of this subject. Is the time they have spent on drafting in the high school a total loss to them? No. For in addition to the esthetic and ethical values they may have developed by means of this subject, this study may become an avocation, an occupation for the leisure moments for many students.

The question then arises: "How can one be entertained by drafting during the free hours?" Is it not a fact that almost daily one comes in contact with students who are wrapped up in their schoolwork, who do an excellent job for the sake of doing it? They have no thought of any practical or vocational application of this subject. Drafting for such students has become a means for self-expression, a creative occupation. It is reasonable to assume that they will not drop it as soon as they leave school, but probably will carry on this self-activity throughout life.

It is quite easy to carry on this avocation in one's home. The equipment needed is neither extensive nor expensive. Drafting does not require much room. A small corner, a table, and a chair, and the workshop is complete. Here one can design one's ideal speed boat; airplane; or develop one's dream house, plan it, build it, and furnish it — all on paper. There is poetry, spontaneous joy, and a great deal of recreational value in such an avocation. But do boys do it? Yes. The writer has a number of instances in mind. One boy has a regularly equipped drafting room at home, where he spends a great deal of his free time over the drawing board planning and developing diverse projects — all on paper. His most ambitious undertaking was the drawing of a complete set of plans for a yacht. He made drawings not only of the hull, but of the engines, boilers, pump, and lighting systems. In brief, he built it in its entirety — with pencil and paper. Born draftsman, perhaps, but he does not intend to follow drafting — he does it for the sheer joy of doing it.

In this case, as well as in others, drafting was instrumental in making the individual capable of using his natural abilities to the best advantage for himself because he found an ideal avocation, and for society because of better citizenship, due to the contributing effects of drafting.

Vocational Drafting

Drafting is also of great importance vocationally. It is the language of industry and of all building activities. No well-informed person will question the assertion that without drafting our industrial civilization would hardly have been possible. When we consider that the building of a skyscraper, or a bridge, the boring of a tunnel, or the sinking of a mine, and every other conceivable industrial enterprise, must be planned first with a pencil on paper, then only may we begin to realize the tremendously important position drafting occupies in our modern industrial setup.

A vast number of our pupils will eventually join the army of industrial and building workers. Unfortunately a large number of them will be unable to read and interpret this language of industry. Yet, the ability to speak or to understand this language has become one of the most important requirements of success for all who are engaged in building or in industrial work. What chances will these young workers have for advancement if they cannot at least read and interpret the meaning of a blueprint?

How many are engaged in building and industrial activities whose occupations would require the knowledge of drafting? The 1930 U. S. Census reports the following number of persons engaged in the different trades, professions, and industries:

Architects		22,000
Apprentices to building and hand trades		40,105
Blacksmiths, forgemen, and hammerers		147,460
Boilermakers		40,923
Brick- and stonemasons and tile layers		170,896
Builders and building contractors		167,310
Cabinetmakers		57,890
Carpenters		929,376
Designers, draftsmen, inventors:		
Designers	20,508	
Draftsmen	79,922	
Inventors	2,300	
		102,730
Electricians		380,379
Engineers (stationary)		256,065
Foremen and overseers (manufacturing)		310,037
Machinists, millwrights, and toolmakers		781,075
Pattern and model makers		29,711
Plumbers, gas and steamfitters		237,813
Technical engineers:		
Civil engineers and surveyors	102,086	
Electrical engineers	57,837	
Mechanical engineers	54,356	
Mining engineers	11,970	
		226,249
Total		3,788,919

This vast army of trained workers must be able to read and to interpret the graphic language in the form of a drawing. It is obvious that those who use drawing greatly outnumber those who make them.

Besides this large group of special workers, there are those who must also use drawings in their occupations: the statis-

tical worker, the city planner, the landscape architect, and many others. The ability to read and interpret blueprints is not only of importance for the mechanic, but for the prospective house owner as well. There is hardly an occupation or a walk of life which does not require the knowledge of drafting to a greater or lesser extent, and in one form or another.

Is it not clearly the school's function to train our youth in this graphic language so that they can go out in the industrial world and be able to occupy their places successfully?

If drafting could not claim any other reason for its existence in the school curriculum, its vocational significance alone should justify its presence in the school as a vital and important subject.

Conclusion

The prime aim of our high schools should not be to train specialists in drafting, but rather to bring motor activity into the school, and to utilize definite manual processes in giving meaning to various facts and principles involved in drafting. In this way the pupil comes into possession of socially desirable habits, skills, attitudes, and a body of knowledge regarding useful and socially necessary work. The main consideration, therefore, should be the complete education of youth, and drafting is one of the very best means to that end, because it is one of the most exact and direct graphic means of expressing one's ideas and calculations on paper. To express one's ideas by means of an accurate and neat drawing means growth in definiteness, in clearness, and in control of ideas. As a means of developing the powers of visualization, observation, and perception, disciplining the imagination, and strengthening the coordination between hand, eye, and mind, mechanical drafting ranks high. As a means of training the pupils in habits of accuracy, industry, logical planning in the solution of problems, and in neatness of execution, mechanical drafting has no superior.

Aside from its great educational value, mechanical drafting is also worth while vocationally. Many students acquire a thorough understanding of and sufficient skill in drafting to give it considerable commercial value, should the students desire to turn this knowledge to account either as mechanics, builders, draftsmen, architects, or engineers.

This then is the contribution of drafting to the complete education of youth: training of the mind in logical thinking, developing ethical character, stimulating the esthetic sense, creating avocational interest, and preparing for a future vocation. A cursory glance at the chart will reveal the fact that not one of the above factors stands alone or independent, but that they are all closely related, intermeshed, and tied together in one integrated whole, the student's personality.

If You Bristle While You Work

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Not only are all of us the unwilling prey of circumstances beyond our control but we are also more or less the victims of our emotions. We differ markedly in how easily and how quickly our emotions get us down. It appears that the immutable law of individual differences that is operative in such rather diverse factors as body temperature, broad jumping ability, flagpole-sitting endurance power, and memory span, to mention but a few, accounts also for the great differences in our degrees of emotional susceptibility to conditions of stress and strain that occur about us and within us.

Unfortunately, we shall always be subject to stresses and strains in the ordinary course of living and consequently our temperamental upheavals and disturbances are with us today and will be with us tomorrow. They are part of us at the breakfast table; while dashing off to make the subway or the 8:15; during the day at the office, bench, or store; and in the innumerable personal and social situations that continually arise to confront us and that make life so interesting and, at times, bewildering.

The label of *normal* or *well-balanced* is pinned on us if we are effectively able to inhibit and more or less to dominate our emotions when they are suddenly aroused. When the emotion gains the upper hand and dictates irrational behavior or thoughts we are thought to be *queer* or *bats* or what have you, depending upon the seriousness of the situation and the tolerance of our friends and neighbors.

Since the environment of this good earth and of our rather mundane society is essentially an irritating and stimulating one, it so happens that the little things in life become in some cases the big thorns in our sides. Things are in our way or else they're missing when we want them. When we get them they're not exactly what we're accustomed to having for the last 'steen years or else they are monotonously the same day in and day out. Looming large on the horizon of the not-so-little things in life that annoy and irritate us are our jobs. They give us the wherewithal for bread, meat, and a comfortable bed but the happiness and the efficiency of the worker rests on something more than just these. Our jobs are, indeed, quite often the source of many emotional disturbances and psychiatric disorders.

Personality adjustment is frequently as important, and often of more consequence in the life of the individual than is training for the job.

Personality Requirements

In late years jobs have been found to have certain more or less specific personality requirements for the men that fill them. Bitter experience has brought home the point that a flagrant disregard of this matter of personality and the job brings trouble! The consequences may be quite serious. "Maladjusted men," says Macrae in his *Talents and Temperaments*, "are like machines that have ceased to function as their makers intended: there is a straining and a jarring in their mental 'works,' and ultimately, in many instances, there is a complete breakdown. For, like any other form of acute mental stress, the profound dissatisfaction occasioned by uncongenial work may conduce to health disorders of a very grave kind."

There are any number of instances of individuals who are carefree and sociable, with extroverted tendencies, desirous of dealing with people and action, who find themselves in jobs where things and thoughts are the commodities of exchange. Let us take the typical case of John who from early adolescence set his mind and heart upon an attractive job in some office where he would have the opportunity of meeting stimulating people and of engaging in interesting things. These are characteristic longings of the typical extrovert. When he graduated from high school he found, much to his dismay, that the job that paid most of those that he was able to locate consisted in cashiering at a local department store. In view of the fact that he was the sole support of his family there was no choice but to take the position. He started off well enough, making an enviable record as far as accuracy, dependability, and perseverance were concerned. Soon, however, a reaction gradually set in and

he found great difficulty in trying to forget the two-column mahogany desk and the comfortable swivel chair that he had envisioned for himself in the spacious office of an important firm. He could not forget the interesting variety of tasks and the numerous contacts with people of prominence that were part of such a job. The daydreaming became more frequent and he began to develop inaccuracies in making change which quite often resulted in a short till when the day's receipts were checked at the end of the day. Holding his mind on the job became an impossible art. Fatigue crept upon him during working hours with insidious regularity and the position gradually became odious and hateful. The job was repetitive, the same thing day in and day out. There was no emotional outlet for a personality that cried out for variety and human company. Everything within him was stifled while on the job. He was about to quit when through good fortune and some persuasion he was able to secure a position in the store's cafeteria as a bus boy which, though paying less, was an emotional tonic to him since it brought him into contact with many people and with the give and take that comes from working among groups.

Besides individual blundering, depressions, recessions, and hard times may complete the job in helping to create more maladjustment and unhappiness. As a result of layoffs, dismissals, lockouts, and the other necessary evils of an imperfect society, vocational adjustment of the individual which may be harmonious and suitable to his temperament and personality is disrupted. As a result he often has to accept work, any work, which may be completely out of gear and distasteful to his make-up.

Promotions, Dismissals, Layoffs

Paradoxical as it may seem, success may be a bombshell at times. The apparently good fortune of promotion to a higher job may turn around and become a boomerang. Oftentimes, the lack of insight that has characterized dismissals and layoffs has similarly been identified with promotions. They have frequently had no regard for consequences insofar as the adjustment of the personality of the promoted individual to the higher position was concerned. To raise, to lower, to use, to dispense with; these have been the prerogatives of the employer. These have made of the individual worker no more than a lever in our fast-moving, heartless industrial machine.

Since the job is part of one's daily life it is but natural that individuals, being but human, should bring to their job the troubles that harass them at home. Some of these abnormal preoccupations may be related to domestic life, some to ill health, some to financial difficulties, some to feelings of inferiority or rejection or anxiety that may arise from any variety of causes. They all act in concert to distract the worker to such an extent that he is worse than useless on the job and a distinct liability to his employer. Worry and anxiety that intrude into the working life of the individual make him wretched and inefficient. We must not forget, however, that quite often ill health receives the blame for inefficiency that really should be laid at the doorstep of personality maladjustment. A change of occupation, new scenery, new adjustments, and presto! the chronic invalid whose headaches and dyspepsia are the bane of friends and employers alike seems to receive new life and displays undreamed-of vim, vigor, and vitality.

There is recalled the case of Agnes, a 19-year-old telephone operator in a well-known department store. Every two or three weeks she would manage to visit the store hospital suffering from dizzy spells and nausea. The physicians could find nothing physically wrong with her and were at their wit's ends to arrive at the cause of her ill feelings. A visit to the store's psychiatric clinic was suggested. It was found that although she had good intelligence and good accuracy and speed of muscular control (favorable for the work that she was doing) she was in a job that called for personality traits that she did not possess. To her the voice at the other end of the wire became an individual who was standing over her ready to pounce upon her if he or she so desired. Since she dreaded meeting people and since the phone to her overworked imagination represented people of ill-tempered dispositions and overbearing insolence she dreaded answering the phone. Of course, in addition she had a poor personality to start with which was not helped by her job placement. Her self-pity and her hypochondriacal centering on her bodily ailments coupled with her gloomy daydreaming make her working days unhappy if not totally miserable. When she was later transferred to one of the private business offices of the store doing clerical work, a position in which she had relatively little contact with customers or dealings with people, her efficiency increased, her visits to the hospital decreased, and her work became entirely satisfactory.

Every year our schools graduate thousands of boys and girls who expect to enter industry. Of these youngsters there are many whose personalities, whose work habits and mental attitudes toward reality, and whose responses to important life situations are so immature and childish that they invite vocational disaster when the hard realities and problems of the job meet them face-to-face. But a greater majority of children at work in industry today are men and women who have never grown up. Although clothed as adults they conspicuously display their childish emotions. Always in their imagination, spectacular success and the dizzy heights of fame are almost within reach. They are still children at the water's edge waiting for ships to arrive that never even started. The transition from wild, carefree dreams to the more sober and more moderate satisfactions of a fair degree of achievement in adult life was never effected. They are unable to meet and solve most of the problems of real life because they are emotionally unprepared for them. Life and work can never offer what these individuals expect. Disillusionment is inevitable.

Chronic Job Changers

Chronic job changing is a major symptom of emotional maladjustment. It has been shown conclusively that vocational adjustment always means emotional adjustment to the job. In nine cases out of ten, it is estimated, the individual who presents emotional disorders and problems while on the job will be found to be vocationally maladjusted. It is not the job that needs changing or adjustment but rather the individual when he cannot seem to find any type of work which is satisfactory. In such cases, seeking relief in new life situations or in new jobs is, unfortunately, very much like the sad dilemma of the young pup running away from his shadow. When things go wrong, when the boss is cranky, when the hours are too long, when the work becomes too heavy, when the pay is low and your indignation is high just remember that the chances are dollars to doughnuts that the fault lies not with the boss, not with the hours, not with the work, and not with the pay but with that grouchy looking fellow who glares back at you from the mirror.

Inability to get along with and to deal effectively with people is one of the greatest obstacles to happiness as well as to success. In this workaday world, where, of necessity, we are thrown into daily contact with hundreds of people, the ability to make others think well of us is truly the open sesame to the things that human beings prize most dearly. Conversely, lack of this ability or failure to cultivate it may often act to deprive the individual of many opportunities to advance vocationally as well as socially. One firm made a study of its job dismissals over a period of years and found the astonishing fact that approximately 65 per cent of the dismissals were due primarily to personality disturbances and emotional disorders and not in any large way to intellectual unfitness or lack of necessary skill or training.

What can be done for the emotionally maladjusted worker before it becomes necessary for him to quit or be fired. If we find the answer we have one way to cut down the ever growing population of our prisons and state hospitals for the mentally disordered. It seems obvious that if the individual is readjusted so that he will find some degree of happiness in his work, industrial vagabondage must necessarily dwindle. The vocational guidance of the future will lay increasing stress on the relation of personality to ability and to ultimate goal. In any case the goal sought will be modified to one within possible

reach since nothing is so devastating to morale and self-confidence as failure. Similarly, nothing feeds the soul so completely as achievement. We can, at one and the same time, assure the happiness of the individual and improve his efficiency as a worker. Surely these are two prime desiderata in this business of living. Strangely enough, they are interdependent. Employers should but realize that the efficiency of their workers goes up as they gain in happiness and contentment. Workers should realize that any attempt that is made to improve their efficiency can only result in less fatigue, greater pride in achievement, and a more lasting happiness in working. Being wedded to one's art should and will be more than a figure of speech.

A sweet-sounding note comes from the fact that personality, because it is fluid, undergoes continuous adjustment and continuous improvement. Personality guidance in industry is relatively new. It is a sane, scientific approach to cutting down the cost of working at the wrong occupation. It is a new way of removing the kink from the square peg so that it will fit more securely into the square hole. It is a therapeutic necessity for those masses of the population who have been condemned by the increased mechanization of our industrial system to types of activities which offer little opportunity for creative expression and individual enterprise. It is not difficult to see that creative expression has little outlet while sitting all day watching a whirligig machine that fills bottles of tomato juice or while punching holes that are exactly three quarters of an inch in diameter in sheets of tin day in and day out.

Since adjustment to work is often intimately related to the larger, more inclusive adjustment to life, the value of personality guidance assumes huge proportions. "The issues involved in work adjustment," says V. V. Anderson in his interesting book, *Psychiatry in Industry*, "do not differ in their fundamentals from those underlying behavior problems in other walks of life." We may yet find that fitting the worker to his job may prove to be the least important of the benefits that will accrue from the new movement.

Juvenile Delinquency and Vocational Education

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A thoughtful appeal to educators to expand their efforts in preparing youth for right living.

According to statistics the number of juvenile delinquents is increasing by leaps and bounds — which makes juvenile delinquency one of the most pressing problems today and one of vast sociological importance.

A generation ago, the reduction of juvenile delinquency was not considered as one of the duties of the public-school system. But today, on account of its vast importance, the public-school system, in co-operation with every other agency, must assist in reducing juvenile delinquency.

An analysis of the whole problem will show that juvenile delinquency is due to the vast industrial changes that have eliminated the employment of young people and to social changes that have weakened the influence of both the home and the church. However, much can be done by the school system in lessening the number of delinquents, by modifying courses and methods of teaching, and by assisting in the co-ordination of business, industry, and art with the home and the church.

The chief problem in dealing with juvenile delinquency is to help the adolescent eliminate his vicious tendencies so that he or she will be a normal, socially and economically adjusted, individual by the time maturity is reached. The word *help* has been used advisedly, because every young person has a desire to be a credit to his father and his mother and to be a success in life. But, due to heredity, environment, illness, and the like, he may not be able alone to overcome his handicaps.

The best way to help the delinquent is to understand him — which involves a knowledge of the growth of young people. We know from a careful study of life that development consists of a number of periods: infancy — from birth to six years of age; childhood — from six to twelve; and adolescence — from twelve to eighteen, or to the threshold of manhood. While most children have the same characteristics up to twelve years of age and present comparatively few problems of delinquency, individuals between the ages of twelve and eighteen differ greatly and offer the greatest number of problems of delinquency. Juvenile delinquency takes place during the period of adolescence and it is this period that we are concerned with from an educational point of view.

Instincts, Habits, Character

During each period of life there appear instincts, or impulses. These instincts are provided for the purpose of developing the individual by means of habits which will enable him to become a successful adult. While everyone has the same number and kind of instincts during each period of life, the instincts differ in intensity from feeble to strong. These differences in intensity are both physical and mental and are the bases of character, or personality, and account for the differences in human nature. The development of instincts through inheritance and environment provide us with habits, either bad or good, depending on the training or environment one has received. While inheritance is an important factor in juvenile delinquency, environment is a stronger factor, and it is possible to overcome in most cases the weaknesses of inheritance.

Instincts properly developed and controlled form excellent habits. Low appetites and vicious tendencies must be modified, else they will develop into poor habits — which will lead to delinquency. To illustrate, vagrancy, for instance, is a continuation of the food-providing instinct of the uncivilized; stealing is the persistence of the predatory (plundering) instinct; gluttony and drunkenness are low food appetites; assault is the persistency of the preying instinct.

Each instinct or impulse once aroused gives a characteristic reaction of the mind, an emotion. To illustrate: fear is an emotion prompted by the instinct for self-preservation, aroused by some incident that recalls an association, or previous experience, of an unpleasant kind.

The emotions play an important part in the life of the juvenile delinquent because they determine the association of ideas in the mind and accordingly affect his judgments, actions, and acts. Therefore, great stress should be placed on the training of the emotional nature so that stability will prevail. During adolescence vicious tendencies, due to uncurbed or uncontrolled instincts may be changed by appealing to the emotions and to the reason. For example, bullying may be changed to chivalry toward the weak; destructiveness into constructiveness; boisterous conduct into enthusiastic activity.

Adolescence

For the purpose of training the delinquent, the period of adolescence may be considered in two parts: from twelve to sixteen years of age, and from sixteen to eighteen.

I. The part between twelve and sixteen is the most critical for the following reasons: (*a*) It is the time when the youth attains much physical growth, thus causing the physical and mental development to become out of balance or equilibrium. (*b*) Many a youth develops an awkwardness during this so-called *clumsy age* which causes him to be ridiculed. Frequently the comparisons made between him and normal students cause him to lose interest in school and in associating with other boys. His awkwardness is caused by the fact that the bones are growing faster than the muscles during this short period of development. (*c*) Secretiveness, bashfulness, and sensitiveness appear which prevent him from expressing his feelings and he is easily misunderstood. At no time in life is he more in need of a strong adult friend — one with feeling and warmth of personality to attract and hold him. The need of a teacher who understands him and who proves to be his first friend of adolescence, will have much to do with his overcoming his weaknesses and preparing himself for future success. (*d*) Adolescents differ in both physical and mental development beginning at the age of twelve. Some may be normal, others retarded, while still others may have more rapid development in the mental, or physical, or both. These differences may be due to inheritance, temperament (nerves) or occurrences (disease, accidents, and the like). During this period the youth may experience a strange restlessness either physically or/and mentally. He thinks of his future and questions the value of an education. Hence, the necessity of offering at this age a type of education that will appeal to him. (*e*) On the other hand, during this period of emotional and physical growth, he may form ideals and strong friendships. This is the time of hero-worship. If his hero is a prize fighter, he will start punching his playmates. Or, if his hero is a gangster, he will imitate the gangster. These ideals should be encouraged but they must be diverted into orderly and definite channels for the boy's good. The club leaders and the physical-training teachers can do much in this field of education. (*f*) With the approach of adolescence, one may find a desire on the part of the boy to be with other boys and to organize clubs and games. This is the development of team spirit and can be used to foster co-operation in school life, and in community life. (*g*) Egoistic emotions quite often appear and are expressed by bullying others or in using offensive names. These and similar emotions are capable of being diverted into courage and chivalry. Hold up to the boy heroes that help the weak and defenseless. (*h*) The instinct of constructiveness appears and should be utilized to advantage in hand work, hobbies, and the like. The destructive instinct can be diverted into an analytical channel by means of physics, shopwork, electricity — how does it work — how is it made?

The Period from 16 to 18

II. Let us now consider the second period — the period of sixteen to eighteen, during which the following develop: (*a*) Loss of interest in school: The boy seeks the companionship and associations of the street and the gang. This instinctive seeking after companionship is perfectly natural. But it is full of dangerous possibilities, unless the boy remains under educational influence which will counteract the evil influences. (*b*) It is also the emotional and enthusiastic age. A restless disposition appears which is associated with dreams of adventure, desire to go away from home with longings for a career. Ambition is strong. (*c*) When the bony structure of the body has formed, the boy's constructive instinct has been fully developed and desire to do vocational work appears. The boy begins to form a sense of achievement, the wish to do things with his hands and to assume an air of responsibility. He absorbs his knowledge more by imitation than by precept and dislikes bookish education. (*d*) At eighteen years of age, the plastic period of life begins to decline and most of the instincts have appeared and disappeared after habits have been formed. In other words, the character of the boy has been formed by the time he has reached eighteen years of age.

Will, the foundation stone of character, must be carefully cultivated during the whole period of adolescence. Every instrumentality of education must be used to encourage the individual and the self-directed activities of the student so that the will may be developed into principle and character.

Juvenile delinquency in most cases, in the beginning, is due to the peculiar dispositions, wild natures and ideas of the adolescent through which he passes in his struggle to manhood and, if supervised under proper educational influences the weaknesses will disappear by the time he reaches manhood. Therefore the teacher must study the individual person so that the instruction may be adapted to individual needs. One may entirely lose power with the adolescent by being either too quick or too slow for him.

All through the education of the adolescent there should be the inspiration of enthusiastic activity and the weaknesses of the adolescent should be used as material for strengthening character by grafting higher possibilities on each weakness. The education employed to strengthen the delinquent must be exercised during the time the instinct and the habit are being formed.

Through our great educational system one will find many principals of junior, academic, and vocational high schools working out the problem of combatting juvenile delinquency, in addition to carrying out the required educational program for the normal student.

Juvenile Delinquency and the School

While no one school has completely solved the problem presented by juvenile delinquency, nevertheless sufficient experiments have been conducted to allow us to lay down definite policies for the ultimate solution of the problem in the public-school system. Experience shows that the following six fundamental policies may be used to advantage in solving this problem:

1. The school curriculum must be broad enough to include special classes for problem cases and delinquents from twelve to eighteen years of age and must interest all types of mentality. This means academic, art, business, and industrial courses properly graded. Art, business, and industry can utilize different levels of skill and intelligence — first- and second-class workers and helpers, or service men. The school should reflect a strong democratic spirit, offering to the problem students or delinquents an education that will interest and develop each mind so as to develop power and self-confidence in the student. This will tend to hold the student in school and to eliminate the tragic sense of failure which is one of the principal causes of delinquency.

2. The teachers and the methods of teaching must be adapted to the characteristics enumerated in the foregoing, for the problem student. The teacher must have not only a sympathetic interest and an honest belief in the possibilities of the student, but the personality to win his respect and confidence, and the power to hold the delinquent in school through his natural interests. The schoolwork must be arranged and studied so as to arise in vital and natural ways in order that the student may see the need of studying the subject and may satisfy his restless intellectual spirit.

Practical work, followed by thinking and reasoning about the work, will appeal to the interests of the delinquent and will show the need for the study of English, mathematics, science, drafting, and other

related subjects. At least 25 per cent of the day's schooling should be devoted to health education — for this type of student — including not only exercises, games, and frequent bathing, but also development of personality and attention to personal appearance. An improvement in physical condition, character, and personality inspires the student to overcome any inferiority complex he may have and enables him to appear to better advantage, and to do his maximum schoolwork. Strong health-education teachers can frequently correct and modify the weaknesses of the delinquent.

3. The philosophy of the secondary school, which naturally determines the attitude of the administrative and teaching staff, must be revised in the spirit of true democracy. Every student, including the delinquent, up to the age of eighteen years, is entitled to a secondary education. Justice shall be rendered to every student in the entire school population and an honest attempt made to inspire every student to do his best work while in school in preparation for his lifework. This means that the secondary-school system will become a clearing house where talents are distributed to the particular courses of training and lines of occupation where individual ability counts for the most in actual achievement. Educational and vocational direction is a basic function of the schools and students must be adjusted, not rejected. Delinquents should be placed in classrooms and shops that are well lighted, properly ventilated, and artistically decorated. Designs, posters, pictures in attractive coloring should be arranged neatly on bulletin boards. Orderly and artistic arrangements have a refining influence on the delinquent.

4. At the age of sixteen provision must be made for the problem student who has lost interest in full-time school. His usefulness can often be developed successfully by a part-time system of education, placing him in either a regular apprentice course, or on part-time instruction. There are certain elements that make part-time education very effective for the problem student or the delinquent. To illustrate: The economical method of production, particularly the workman's time as a factor in the cost of production, is difficult to demonstrate to a student in a school where his wages do not depend upon his actual productive ability. The economy required for a commercial product can be understood to best advantage by the intensely practical mind of the delinquent *only* when his product is put to commercial use, and when he sees an incentive in the form of wages for his judgment and skill in producing the product. Wherever possible, the business, factory, or shop should cooperate with the school so that shop practice may be given in the factory shop, and the related technical and academic work in the school.

Under such a system of education the delinquent, who has found it difficult to maintain interest in school on a full-time basis, will see at work, many needs for schooling of which he was previously unaware. Responsibility provokes thought and a realization of the need for more information and training. In this way the period of intellectual growth will be greatly prolonged and the desire for knowledge and skill will be strengthened.

5. Various types of clubs and hobbies should be established after school hours for the problem boy so that he may find a hobby or an interest that will keep him inspired with enthusiastic activity. Arrangements also should be made with community centers and clubs to hold the interest of each delinquent.

6. Students should be encouraged to join a regular club for re-enforcement of church training, and efforts should be made to have the student enroll in a Menorah, Newman, Y, or similar Club. Character training for the delinquent requires a strong religious influence to secure maximum efficiency.

It is absolutely necessary in the case of delinquents that the school keep constant touch with the home. The home may be the greatest force in curing delinquency but, due to many subversive influences such as unemployment, unsympathetic stepfather or stepmother, broken home, or other evil conditions, the home may lose its strongest force. Nevertheless, however weak the home may be, it can be strengthened by the school authorities and teachers constantly reminding the parents of their duties and obligations to their children, and the children of the proper attitude toward their parents.

Juvenile delinquency can be reduced and every effort should be made by the city government to provide funds sufficient for the public-school system to meet the needs of this special problem. Every dollar spent by the city government in solving this problem will be returned many times in deferred values. Compare the cost of special class instruction from twelve to eighteen years of age at $250 a student for each year, with a cost of detection and housing of a delinquent for a shorter or greater part of his life, to say nothing of the human element — the loss of the man as a father, worker, and useful citizen of the community.

Evolution of Our Alphabet

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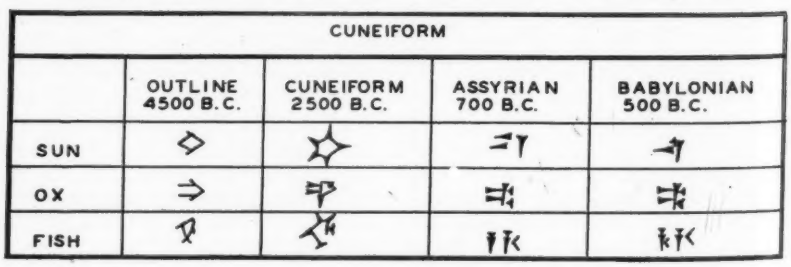
Adding a bit of interest to the lettering which the student learns in his drafting classes.

Some of the great prehistoric inventions such as the making of fire, the use of tools, the wheel and axle, the steam engine, the internal-combustion engine, and the development of electricity, fundamental as they are to our civilization, seem unimportant in comparison to the benefits which civilization obtained through the discovery of the phonetic alphabet.

Men learned how to make pictures in very early times. In some of the caves of southern France and northern Spain there have been found very interesting traces of life long before written history began, and among these are pictures representing scenes of those prehistoric times, but there does not seem to be a development of any kind of writing.

Other ancient peoples, though by no means as ancient as the cave dwellers of southern Europe, did develop a means of expressing ideas by pictures, and so made for themselves a system of writing. Time and numbers were easily indicated by



knots in cords and notches in sticks, and gradually various forms of information were conveyed by rough drawings of natural objects on skins, bone, clay, and stone. When America was discovered, the Indians had progressed so far in this art of ideographic or picture writing that they were able to record events and to express such abstract ideas as war and peace with codes and symbolic signs. This picture writing sufficed for a limited thought and simple needs of primitive tribes. In Egypt and Babylonia this stage was reached as early as the year 4000 B.C. The ancient people of the old world, who reached a high degree of civilization, required such a vast number of ideographs to express their complex life that the method of picture writing became cumbersome and confused. The arrow or the pointing hand are traces of picture writing which still survive in our own language.

All writing was in its origin pictorial. It began with ideograms, which developed into phonograms. Ideograms are pictures or symbols intended to represent either objects or abstract ideas. Phonograms are the graphic symbols of sounds. Five independent systems of ideographic writing have been invented: (1) The Cuneiform, which arose in the valley of the Euphrates; (2) the Chinese, out of which the Japanese syllabaries have arisen; (3) the Hittite; (4) the Mexican picture writing; (5) the Egyptian hieroglyphics, from which the Phoenician alphabet was derived.

The Egyptians, Babylonians, and Chinese took the next step by conventionalizing the picture. Until a little over a hundred years ago nobody had been able to read the ancient Egyptian records. These had ceased to be written shortly after the beginning of our era, and, since it was the priests who had recorded the language it was soon claimed that the strange looking pictures had only a mystical meaning. The descendants of the Egyptians, the Copts, were of no assistance because they had long ago forgotten the writings of their forefathers. Learned men spent years trying to decipher the puzzle of the mysterious designs which covered the walls of the ancient temples and pyramids. On these Egyptian monuments there are carvings of snakes, owls, hawks, geese, lotus flowers, hands, heads, lions with bird's heads, beetles, palm leaves, people with their hands raised above their heads, and people sitting on their haunches. These are all drawn in long lines like sentences in a book. Among these pictures are innumerable geometric designs of every description — squares, triangles, circles, and loops. Many fantastic theories arose and retarded the efforts of the scholars, but at last the secret of the hieroglyphics was discovered.

An engineer of Napoleon's army was stationed in the year 1799 in a little fortress near Alexandria on the Rosetta River, which is one of the mouths of the river Nile in Egypt. He was interested in the ruins which were all about him of the ancient civilization of the Egyptians. As they were digging trenches in the neighborhood of the Rosetta River the soldiers excavated a huge flat stone with an inscription on it in three kinds of writing. This young French engineer took good care of the stone and turned it over to the scholars who were puzzling over the Egyptian carvings. Thomas Young, the famous English physicist, made the first important step toward solving the puzzle of the hieroglyphs by reading on another inscription the names of Ptolemy and Berenice. In 1802, a French professor by the name of Champollion began to work on the inscriptions, trying to study out by the Greek key how the Egyptian characters told the same story.

Champollion worked for nearly twenty years on that stone. He identified the names of Ptolemy and Cleopatra on an obelisk shaft and from them had learned the sound value of twelve letters. In 1823 he announced to the world of scholars that he had found out what fourteen of these signs meant. It was at this point that he was able to make full use of the Rosetta stone. The Greek of the inscription was clear to him, and that, with a knowledge of other oriental languages, enabled him to add to his list of known signs and discover the meanings of the words and the construction of the language. The Rosetta stone was the key which unlocked all of the written records of Egypt and made known to the world the history of a people which had lived so many thousands of years earlier that knowledge of them had disappeared from the world. Prehistoric man lived, ate, slept; and the records of his life perished when he and his family and friends died. The Egyptians wrote their records on stones or with pen or brush on paper made from the papyrus plant. It is interesting to note that the Mayas of Southern Mexico, the most advanced American Indians, developed the art of writing up to this point before they were destroyed by the warlike Aztecs. As a literary medium the hieroglyphic writing is not to be despised. It expressed the varied culture of the Egyptians and the Babylonians, and in it the Chinese have preserved their numerous writings, including those of the philosopher Confucius. Chinese writing has never advanced beyond this stage. Today the pictorial characters of the written language are still painted with brushes, just as they were in ancient times.

By 3000 B.C. Mesopotamia had gone through the laborious stages which led to civilization. The system of writing used began with pictures, just as in Egypt, but the Babylonians developed their script in an altogether different way. The reason for this is that the clay tablet came into early use as the object on which writing was recorded. In Egypt there was plenty of stone and papyrus but these materials were lacking in Babylonia. As a result the Babylonians developed the use of the stylus for impressing wedge-shaped characters on the soft clay tablet. In this way the original pictures were represented in increasingly angular form until finally they became so conventionalized that the originals can be detected only with the greatest difficulty. This type of writing is called cuneiform. Scholars spent many years trying to decipher it. Slight progress had been made by 1800, but it remained for a German schoolmaster named Grotefend actually to identify the names of Darius and Xerxes.

In many cases the development of the cuneiform characters from the Egyptian hieroglyphs can be distinctly traced. Each sign employed consists of a wedge or a combination of wedges written from left to right. The wedge points to the right, downward or aslant, and sometimes two are joined to form an angle. Cuneiform writing is difficult to translate, because a character may represent a syllable or a whole word. Of the various forms of this writing, the Persian is the simplest, because each sign stands for a word or a consonant and a vowel. The Assyrian-Babylonian is the most complicated and also the most important, because of what it has revealed to the modern world of the history of the ancients, and especially of the people mentioned in the Bible.

About 1300 B.C. a new nation came into power in this region, which had great influence on the later languages. This was the nation of the Phoenicians, who inhabited a strip of country at the eastern end of the Mediterranean Sea, south of Asia Minor. Their two chief cities were Tyre and Sidon. The Phoenicians were sailors and merchants, and possibly as a result of their need for a means of writing in connection with their business affairs, they developed or borrowed an alphabet from the Egyptians and added a very valuable discovery; that of writing words with letters. For their alphabet, the first alphabet in the world, they took only about twenty of all the Egyptian picture hieroglyphs. It is believed that the alphabet originated from a system of trade-marks used by the Egyptian merchants or traders. According to this theory each merchant had his own trade-mark by which he identified his goods much as the western ranchers use their own particular brand for the identification of their cattle and as the lumbermen identify their lumber at the mill. When the Phoenicians discovered the idea of a phonetic alphabet they imitated the Egyptian hieroglyphs but gave them Phoenician sounds.

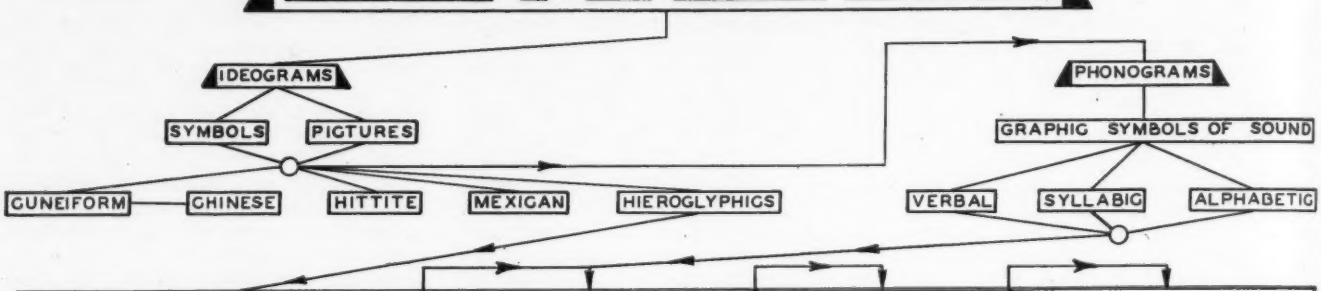
A knowledge of the alphabetical writing must have been obtained by the Greeks from the Phoenician trading settlements in the Aegean as early as the 12th century B.C. The Greeks did not realize the value that lay in the complicated hieroglyphs of the Egyptians but they conceived uses for several of the symbols. The Greeks were interested only in the sound value of the signs and the foreign names were hard to correctly pronounce so that the Phoenician "Aleph" became the Greek "Alpha." The oldest forms of the Greek alphabet are not to be found in books, but in inscriptions cut in stone,

and these letters in these inscriptions are quite similar to those used in the inscriptions which employ the Phoenician letters. These old Greek inscriptions were not written and read from left to right as is true of English and most other modern languages, but from right to left. When the Greeks began to write from left to right, as we do, the form of some of the letters were reversed. The Greeks could clumsily repeat the names, but they apparently did not know the things which they were supposed to represent, so that finally the Greek characters bear very faint resemblance to the Phoenician original drawings. Some scholars attribute the changes to the Greek sense of unity, variety, and rhythm. The Greeks made another improvement in the alphabet as it was given to them. The old alphabet consisted of consonants. There were no vowels; the Greeks gave the "aspirates" vowel sounds. There were twenty-two letters in the Phoenician alphabet. The old Greek alphabet had twenty-seven letters; a few of the Phoenician letters had been dropped, and vowels and consonants with double sounds, such as "phi," "chi," "psi," and "xi" were added. In the classical Greek alphabet there were twenty-four letters, three of the letters having been dropped as unnecessary.

The Greek alphabet was the source, not only of the Latin, but of the other national alphabets of Europe except Russia and some of the smaller nations of southeastern Europe. The Romans spread the alphabet all over western Europe. The armies of the Roman conquest carried it with them, and left it wherever they went. Thus it passed into Gaul, whence St. Patrick introduced it into Ireland. Irish missionaries to Britain took it to Northumbria, and thence, when Alcuin of York was summoned by Charlemagne to establish a center of learning at Tours, it returned to France, to go again to Britain with the Normans.

In our own alphabet, the order of letters does not differ very greatly from the Phoenician arrangement, but the few

EVOLUTION OF OUR MODERN ALPHABET



	EGYPTIAN		PHOENICIAN - 1300 - 1000 B.C			GREEK - 700 - 500 B.C.		ROMAN - 300 - 800 A.D.	
	HIEROGLYPHIC	HIERATIC							
A	EAGLE		OX	ALEPH		ALPHA		A	AH
B	CRANE		HOUSE	BETH		BETA		B	BAY
C	THRONE		CAMEL	GIMEL		GAMMA		C	KAY
D	HAND		DOOR	DALETH		DELTA		D	DAY
E	MEANDER		WINDOW	HE		EPSILON		E	EH
F	CERESTES		HOOK	VAU		DIGAMMA		F	EF
G									
H	SIEVE		FENCE	CHETH		ETA		H	HAH
I	PARALLELS		HAND	YED		IOTA		I	EE
J									
K	BOWL		PALM	KOPH		KAPPA		K	KAH
L	LIONESS		WHIP	LAMED		LAMDA		L	EL
M	OWL		WATER	MEM		MU		M	EM
N	WATER		FISH	NUN		NU		N	EN
O			EYE	AYIN		OMICRON		O	OH
P	SHUTTER		MOUTH	PE		PI		P	PAY
Q	ANGLE		KNOT	KOPH		KOPPA		Q	KOO
R	MOUTH		HEAD	RESH		RHO		R	AIR
S	GARDEN		TEETH	SHIN		SIGMA		S	ESS
T	LASSO		MARK	TAHV		TAU		T	TAY
U						UPSILON		V	OO
V								V	
W									
X	CHAIRBACK		POST	SAMECH		XI		X	EEX
Y									
Z			WEAPON	ZAYIN		ZETA		Z	ZAYTA

changes are historically instructive. The last Phoenician letter was *T*, which in our alphabet is followed by six letters. The Greek alphabet contains four letters not included in the chart, three of which found use in the Latin and thus passed into the modern European alphabets: *V* or *Y*, from which we have *V*, *U*, *Y*, and *W*. In the time of Cicero the Romans began to use *Y* and *Z* for the transliteration of Greek names and added them at the end of their alphabet. During the Middle Ages, *I* and *J* were differentiated, the latter being used to denote the consonantal value of the semivowal with the sound of the English *Y*, and being employed also at the end of words, as is still frequently the case in Italian. A like distinction was made between *U* and *V;* and to represent the Teutonic labial aspirant, not found in Latin, two *V's* were combined into a character called "double *u*" (*W*). At first *C* and *G* were not differentiated, but later *C* was modified to replace the *K* sound.

— A —

Almost all of the alphabets of the world, no matter how unlike they may be in other respects, have *A* as their first letter. It seems probable that the Phoenicians, who represented their *A* as an ox's head, forgot in time that it was a picture symbol and turned it over on its side and tried to make it in one continuous stroke. A was "Aleph" in the Phoenician language, and was not a vowel, but a very light *h* breathing sound. When the Greeks adopted it they forgot all about the picture quality of the symbol and turned it around so that its head was now upside down. The Greeks had some difficulty in pronouncing it as the Phoenicians did and called it "alpha" instead of "aleph," the Romans called it *A* (ah) and we give it the sound of *A* (ay).

— B —

Its name in the Phoenician alphabet was "beth," which meant house, and it is thought by some that the second letter of the alphabet was intended to roughly outline a house with one side left open to represent a doorway, while others believe that it represents the plan of a house. The Greeks were not concerned as to the picture or the name of the character and represented it with two triangles instead of the square supporting the triangle, and changed the name from "beth" to "beta." In this manner arose the word *alphabet* — "aleph-beth" to "alpha-beta" which originally meant oxhouse. The Romans shortened the word *beta* and called it *B* (bay) and softened the straight lines into curves. Those familiar with the Bible will be acquainted with the words *bethel* (Hebrew for house of God), and *Bethlehem* (Hebrew for house of bread).

— C and G —

The Phoenician letter from which the Greek "gamma" was taken, and through which our modern C was derived, was supposed to have been a picture of a camel's head, "gimel" or "gamel." The head could easily be represented by the long neck and the angular relationship of the neck to the head. The Greeks simplified the shape into a symbol much like the figure 7 and changed the name to "gamma." The Romans when they borrowed it introduced the curve and gave it both the hard and soft sounds (kay) and (gay), about A.D. third century to distinguish the *G* from the *K* sound, so they formed *G* by adding a bar below the opening of the letter.

— D —

The letter *D* probably represents the door of a tent. Particular importance is attached to the door of a tent in the Asiatic countries because of an established custom which guarantees a stranger and even an enemy hospitality in the form of food, drink, and shelter upon entering through the door of a tent. The Phoenicians called the character "daleth." The Greeks changed the name into "delta" and the Romans rounded the angle of the character and called it *D* (day).

— E —

The Phoenician letter *He* (hay) represented a window with one side of the frame missing. The Greeks used this sound at first for the long *E* (epsilon) but later used the symbol *H* (eta) for their long sound, and turned it around from left to right, almost like a capital letter *E*, which has come down from it. The Romans shortened the sound to *E* (eh).

— F —

Shipbuilding was an important industry of the Phoenicians, those famous merchants and sailors of the Syrian coast, who used the representation of a hook or nail, "vau" for their letter F. The Greeks called the letter "digamma" (double gamma) and its form represented one "gamma" (Greek *C*) written on top of the other, and had the sound of W. The Romans called it *F* (ef). Strangely enough, our numeral 6 is a survival of the Greek "digamma."

— H —

In the Phoenician records this letter consisted of two uprights connected by the transverse bars, at first either two or three in number. The uprights were rarely perpendicular and the crossbars are not so precisely arranged as they are in the early Greek and Latin alphabets. In these the symbol takes the form of two rectangles, out of which the *H* develops by the omission of the crossbars at the top and bottom. The Phoenician name for the letter was "heth" (haith), meaning fence or enclosure. The Greeks called it "eta" (ata), and the Romans gave it the soft *H* (hah) in the form that is now used.

— I and J —

The name in Phoenician was "yod," which meant hand and in its original form it was made somewhat like a tall narrow Z. The letter was a rude sketch of a hand, bent at wrist and knuckles. Like all other letters in the Phoenician alphabet, "yod" was a consonant, but approached a vowel sound; and the Greeks, when they adopted it, made it a vowel with an "e" sound, and added an "a" and called it "Iota" (e-ota). After various modifications it was straightened into its present shape. With the Romans it represented the long "e" sound as it did with the Greeks, but the Romans found that in certain words it had the force of a consonant, and later writers adopted a slightly different form for the letter in its consonant use. The distinguishing letter J did not come into use until the seventh century. The sound value of J is not what it was with the Romans, theirs being rather the sound of the English Y. The dot above the "i" was first used during the thirteenth century.

— K —

The *K* (kaph) was in form a *K* turned backward. The name *kaph* meant hollow of the hand, and it may be that the letter attempted to represent the silhouette of the open hand with its radiating lines. It is possible that the early belief in palmistry had its influence on this particular character. The Greeks adopted the letter and called it "kappa"; when they began to write from left to right instead of from right to left as did the Phoenicians, they turned it around, giving it practically its present form. The Romans used *C* to represent the hard guttural sound, and had in consequence no use for *K*. It was not until the Normans introduced in English the soft *C*, that *K* came to have any particular importance in the English language.

— L —

The next letter was derived through the Greek and Roman from the Phoenician symbol of the whiplash or oxgoad. This object was familiar to the ancients because herding sheep and oxen was the important agricultural occupation of the Phoenician slaves. The Greeks added their favorite vowel *a* and called it "lamda," and changed the shape of the letter to that of an inverted V. The Romans turned it back to its original position and gave it the sound with which we identify the modern character.

— M and N —

The Phoenicians were sea traders and explorers, and it is said that they explored the shores of the Mediterranean and through the Strait of Gibraltar until they found Britain. They were the most skillful sailors of antiquity, and from early times their ships carried cargoes to all parts of the known world. Because of their close association with the sea it is not surprising to find that they used the symbol "mem," which meant water, and represented the character by a wavy line, which represented water in motion. The Greeks and Romans gave to the letter the shortened form of "em" which all through the centuries has been surprisingly free from the confusion of the other letters.

Like *M*, *N* has come down to us with little change or form or value from the Phoenician alphabet, though in the course of change of direction of writing to the present right to left method, the letter has been turned around. The Phoenician name of the letter was "nun" (noon), which represents a hanging fish as pictured by a fisherman rather than the swimming fish as pictured by the angler. The Greeks called it "nu" and the Romans accepted its form but called it *N* (en).

— O —

The Phoenician alphabet had a letter which in form was like the capital *O*, and was called "ayin," meaning eye; but like all of their letters it was a consonant. Just what sound it represented is not known, but it must have been some sound for which the Greeks had no use, for when they took over the alphabet, they used the letter form to represent the sound as we use it; perhaps the use was suggested to them by the rounding of the lips to give this sound. The original form of *O* was a more or less roughly formed circle. In the Greek alphabets the circle sometimes appears with a dot in the center, but in many cases it is doubtful whether the mark is intentional or is only the result of fixing a sharp point there while describing the circle. The Greeks used it for two sounds designated by "omicron" (short *o*) and "omega" (long *o*). It was the last letter in the Greek alphabet, as alpha was the first; as in the expression in the Bible, "I am the Alpha and the Omega, the beginning and the ending."

— P —

The Phoenician "pi" (pe), meant mouth, but there is little in the vertical bent to the left at its top which particularly resembles this feature. This form was also used in the early Greek, but with the crook directed to the right. Afterward the crook was made angular, and finally the two downward strokes were made equal. The Romans accepted the

Phoenician form but continued the curve farther, and called it "pe" (pay).

— Q —

In the Phoenician the name "qoph" meant head and was represented by a rough ellipse transfixed by an upright line. In Greek the head of the symbol is generally circular, and only in a few early inscriptions is the upright carried through the circle. In Greek this letter was called "koppa" but it was early displaced by "kappa" (*K*). Some of the ancient Latin grammarians regarded *Q* as a contracted form of *CV* (cu); but others recognized in *Q* a modified form of the "koppa" of the early Greek.

— R —

The Phoenician letter from which it was derived was called "resh," which meant head, the letter rudely representing a face in profile. It was more like a *P* than an *R*, but it was turned around with the projection to the left, and this upper part was angular instead of curved. The Greeks turned the letter around making it exactly like the Roman *P*, and called it "rho." The Romans added the tail to the letter and called it *R* (air).

— S —

The Phoenician letter from which it was obtained was shaped much like a capital *W*, and was called "shin" or "sin" which meant teeth. No doubt it was intended to represent a toothed edge rather than the teeth of a human being. The Greeks turned the letter to a perpendicular position, and called it "sigma," and the Romans, when they adopted it, dropped the lowest line and rounded it into the form of the modern capital *S* (ess).

— T —

This letter is particularly interesting because it came from "tahv," a mark or cross made as a signature by people who could not write, and is in use to the present day. Charlemagne and other kings of the Middle Ages used stencil plates to make their mark or signature upon important documents. In both the Greek and the Latin, however, although the upright and cross strokes are not exactly at right angles and the upright often projects beyond the cross stroke, the forms approach more nearly to the modern than to the Phoenician shape. The Greeks changed the letter to "tau," and the Romans raised the crossbar and called it *T* (tay). The Anglo-Saxons, when they adopted the alphabet from the Romans, added two letters, one of which was called "thorn," and had the sound of "th." It was shaped very much like a capital *Y*, and probably because of this confusion from the likeness soon discarded it.

— U, V, W, and Y —

These letters all came into our alphabet from the Latin, and are all modified forms of the Greek *V* (upsilon), which was pronounced like the English (*oo*). Some scholars trace the Greek letter back to the Hebrew form of "ayin" which closely resembles the *Y* in shape. It was written at first like a capital *V* or *Y*, but gradually the letter *U* came to be used almost exclusively by the Greeks, while the Romans used the angular *V*. The *U* and *V* were interchangeable but later the *V* was given a vowel sound, but at the beginning of words it had a consonant force like the English *W*. In time the rounded *U* came to represent the vowel sound, while the angular *V* stood for the consonant.

During the thirteenth century our Anglo-Saxon forefathers contributed two letters, *W* (wen) and another which resembled the *Y*. The French called the *W* (double vay) and in the English it may be said to represent double *U*, as its name indicates to the present day.

— X —

The Phoenician alphabet had no sound which corresponded to the English *X*; but it had a consonant with an s-like sound which bore the symbol shown in the chart. This symbol was used to represent a rough sketch of a post or pillar, and the Phoenician name for this was "samech," which meant support. It may have originated from the Greek *ks* which later became the Roman *X* (eex).

— Z —

The Phoenician name for the character, which was the seventh in their alphabet, was "zayin," meaning dagger or short sword, and the symbol represented a rough sketch of the handle and part of the blade. In the Greek alphabet *Z* (zeta) was the sixth letter. In the middle of the first century B.C., when Greek influence was strong, the Romans needed a sign to represent the "zeta" in Greek names and the names of Greek derivation. Accordingly they added *Z* at the end of their alphabet. Practically all of the words in Latin spelled with *Z* and nearly all the words beginning with *Z* in English are of Greek origin.

There are other theories of the source of the alphabet, notably a theory that the Phoenicians took their alphabet from the Philistines, who are then supposed to have brought theirs from Crete, who, in turn, no doubt, took its alphabet from Egypt.

Another theory credits the Sinai Peninsula with an alphabet about 1800 B.C. During the 12th Dynasty Egyptian kings sent numerous expeditions to the mines and in this manner the Egyptian hieroglyphs were adopted and passed on to the Canaanites, Phoenicians, Hebrews, and Ethiopians.

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History of Woodworking Machinery

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A unit on woodwork machinery is found in almost every high-school course of study and yet a good text is not available; in fact, I found very little reference material for either the teacher or student. In related work for woodwork machinery, a paramount need is the history of these machines, because the boys cannot be told that these things "just growed, like Topsy." Material on this is absolutely nil in the field of industrial-arts literature, so far as I could find out.

An appeal for information was made to machinery manufacturers and the United States Department of the Interior, books were perused, and the older volumes of *Forestry* were searched. Among all of this mass of material, there were but seven books which gave some of the pertinent facts on the subject. The following contains the findings obtained from these many and varied sources.

The Saw. The inventor of this instrument has, by the Greeks, been inserted in their mythology, with a place in which, among their gods, they honored the greatest benefactors of the earliest ages. The first saw was formed, most likely, of the jawbone of a snake or the backbone of a fish. The invention of it is ascribed variously by ancient Greek historians to Daedelus, Perdis, and Thalus, but that it antedated those mythological personages by a hundred thousand years or so, there is little doubt. Figures of saws have been found on some of the oldest Egyptian monuments which antedated Greek civilization by several thousand years. The saws of the ancient Greek and Roman carpenters were quite like those that we are using today, as is shown by a painting of one found during the excavations of Herculaneum. The early Chinese also used saws.

A real effort to gather information about the early beginnings of harnessing the machine to the working of wood.

The Pit Saw. Man is a notorious imitator, and hence, when he sets about to invent a machine, he nearly always begins by trying to couple the hand tool that had previously been used for the purpose with some kind of mechanical movement. The first machine for sawing wood was con-

structed on the same lines as the hand saw; that is, extra power applied to a reciprocating movement. This was done by using a big saw, which was operated by at least two men, one of whom stood in a pit across which the log was placed, while the other was over the pit. The saw was pulled up and down.

The Muley Saw. This was similar to the pit saw except that machinery now replaced the men. This type of sawmill, using water power, was operated in Europe as early as 1337. When the Infant Henry sent settlers to the island of Maderia, which was discovered in 1420, he ordered that sawmills be erected for the purpose of sawing into usable lengths, the various species of excellent timber found there. In the year 1555, the Bishop of Eby, ambassador from Mary, Queen of England, to the court of Rome, having seen a sawmill in the neighborhood of Lyons described it in the following words:

"The saw mill is driven with an upright wheel; and the water that maketh it go, is gathered whole into a trough, which delivereth the same water to the wheels. This wheel hath a piece of timber put to the axeltree end, like the handle of a brooch, and fastened to the end of the saw, which, being turned with the force of the water, hoisteth up and down the saw, that it continually eateth in, and the handle of the same is kept in a rifall of wood from swerving. Also the timber lieth as it were upon a ladder, which is brought by little and little to the saw with another vice."

In the sixteenth century, there were mills with different saw blades, by which a plank could be cut into several deals at the same time. Pighius saw one of these in 1575 on the Danube, near Ratisbon, when he accompanied Charles, prince of Jieliers and Cleves, on his travels. The first American sawmill run by water began work in 1643, on the Falls of the Piscataqua on the line between Maine and New Hampshire. Gang saws, that is, notched blades put side by side, were soon introduced in this country. Although many improvements have taken place since then, Kaempffert's book has an illustration of a simple-blade, up-and-down saw still in operation in the backwoods of Pennsylvania in 1931.

The Circular Saw. This type of saw was invented in Holland, about the year 1700, but the genius that conceived the idea of cutting teeth into the periphery of a steel disk and rotating it at high speed, so that a continuous sawing action would result, is unknown. At the time that the circular saw was invented, the Dutch were far ahead of any other country in the design and construction of mechanical devices, but after they made a fundamental invention, they seem to have done very little to develop it.

The circular saw might be called a rediscovery, as a small tool like it was used by Hippocrates in cutting holes in the skulls of some of his patients in ancient Greece, to relieve pressure on the brain; an operation which physicians and surgeons call trepanning.

The earliest authentic record and description of a circular saw is to be found in the British patent granted to Samuel Miller, in 1777. His invention would have been practically unknown, however, had not General Sir Samuel Bentham, a manufacturer of power tools, taken an interest in it. Miller's machine had in it nearly all the improvements that are found in the modern circular sawing machine, since it was fitted with a carriage, and had a compound movement and a "rack bench," as the English call it.

Benjamin Cummings is credited with being the American inventor of the circular saw. He knew little or nothing of the progress of saw making in Europe, but started out on his own account. He was born at Bentonville, New York, in 1772, and came of old English stock. A millwright by trade, he made the first circular saw ever seen in America in his own blacksmith shop, while the villagers looked on in wonder. He intended it for use in his own sawmill at Schenectady, New York, and although it took some time to adjust it to the existing power, he was finally successful.

With the increased diameter and peripheral speed of the circular saw, a grave difficulty arose. The saw would heat at its periphery, and its rim portion expanding without commensurate expansion of the central portion, would cause the saw to crack and fly to pieces under the tremendous centrifugal force. This difficulty is provided for by what is known as "hammering to tension," e.g., the saw is hammered to a gradually increasing state of compression from the rim to the center, thus causing an initial expansion or spread in the molecules of the metal near the central parts of the saw. An elastic expansive force is thus stored up that accomodates and counteracts the unequal and destructive strain, due to the expansion of the rim from the great heat of friction in passing through the log.

Hammering out the first American circular saw in 1814 was another one of Cumming's many accomplishments.

The day of the circular saw had been hastened by the granting of an American patent to Robert Eastman and J. Jacquith, of Brunswick, Maine. Eastman arranged for putting into the rims of his saw some extra notches, which he called "false teeth." About 1840, circular saws appeared, into which teeth had been fitted. Then, in 1846, an inventor named Spaulding, of Sacramento, California, devised a curved socket which held the "false teeth" more securely. This plan made circular saws popular because they could be easily repaired by putting in a new tooth when one was broken.

Mounted upon a portable frame, this early saw was used extensively upon the logs in the forests of the United States, and for many years this type of sawmill held its sway, and an enormous amount of work was done through its agency. Among its useful accessories were the set works for adjusting the log-holding knees to the position for a new cut, log turners for rotating the log to change the plane of the cut, and the rack and pinion feed, by which the saw carriage was moved back and forth. Following the rack and pinion feed, came the rope feed, in which a rope wrapped around a drum was carried at its opposite ends over pulleys and back to the opposite ends of the carriage, which was thereby carried back and forth by the forward or backward movement of the drum.

The greatest advance in sawmills in recent years has been the steam feed, in which a very long steam cylinder was provided with a piston, whose long rod was directly attached to the saw carriage, and the latter moved back and forth by the admission of steam alternately to opposite sides of the piston. This type of feed, also known as the "shot gun" feed, from the resemblance of the long cylinder to a gun barrel, was invented by DeWitt C. Prescott, and is covered by his patent, No. 174,004, February 22, 1876, later improvements being shown in his patent, No. 360,972, April 12, 1887. The value of the steam feed was to increase the speed and efficiency of the saw, by expediating the movement of its carriage, as many as six boards per minute being cut by its aid from a log of average length. With the modern development of the art, the ease and rapidity of steam action have recommended it for use in most of the work of the sawmill, and the direct application of steam pistons working in cylinders has been utilized for canting, kicking, flipping, and rolling the logs, lifting the stock, taking away the boards, and the like.

The Band Saw. This saw is believed to have been invented by William Newberry of London. In a patent granted to him in 1808, he describes in detail the pivotal table, the radial guide, and the feed rolls, all of which are embodied in the machine as now constructed.

The French have always declared they invented the band saw, but the first official notice we have is a French patent granted to Etiennot, on March 25, 1834. Many French inventors gave their attention to the band saw, and among them was Mademoiselle Crepin, a young woman of Paris, a member of a family of high so-

cial standing. She did not care for a life of fashion, and devoted herself to mechanical pursuits. Among her inventions was a band saw, for which she obtained a French patent in 1846. Its merits were seen by Perin, a saw manufacturer and an inventor of saws, and he bought her rights. He exhibited a band saw, a composite invention in 1855, at the French International Exhibition in Paris.

The first United States patent for a band saw was granted to B. Barker, January 6, 1836, but it remained for the last quarter of the nineteenth century to give the band saw its prominence in woodworking machines.

For many years, the only moderateiy successful band saws were made in France, but expert mechanical skill had so mastered the problem by 1900 that the band saw at that time was at the very front in woodworking machinery. In fact, even then, they had blades in service, running from a delicate filament for scroll sawing, to an enormous steel belt, 50 ft. in peripheral measurement, and 12 in. wide, traveling over pulleys 8 ft. in diameter, making 500 revolutions a minute, and tearing its way through logs much too large for any circular saw, at the rate of nearly two miles a minute. Since 1900, blade sizes have increased. In 1924, blade widths of 18 in. were quite common so it is possible that the 1900 width of 12 in. has been doubled by the present time. Prescott's patents of 1887, 1889, and 1892 represent some of the important developments in the band saw.

When the band saw is applied to cutting logs the backward movement of the carriage would, if there were any slivers on the cut face of the log, be likely to force those slivers against the smooth edge of the band saw and distort, and possibly break it. To obviate this, the saw carriage is provided with a lateral adjustment on the back movement called an "offset," so that the log returns for a new cut, out of contact with the saw. Examples of such offsetting are found in patents to Gowen, May 29, 1888, and Hinkley, August 23, 1887. A modern form of the band saw has teeth on both edges which requires no offsetting mechanism, as the saw cuts in both directions. An example of this, known as the telescopic band mill, was made by the Edward P. Allis Company of Milwaukee.

One of the sensations of the Centennial Exhibition in Philadelphia was a band saw in swift operation, which had just been perfected by the well-known saw manufacturers, Henry Disston and Sons, Incorporated. From that date may be traced the introduction of the band saw into the American mills. There has long been a keen rivalry in American mills, between the band saw and the circular saw. For the portable mills, the round form is more popular, as it can be easily taken about the country and into remote places near the lumber camps. The standard circular saw is 54 in. in diameter, although one of the type, said to have been the largest in the world, was 108 in. across.

Since it saves kerf, time, and power, the band saw has a front place in all the big mills. Mill operators in the larger towns, and in the centers of industry, like the band saw, because its thin blade, rapidly revolved over wheels, makes a very narrow cut and wastes little wood in dust. In the seventies, a 6-in. band saw was considered remarkable, but now 18-in. ones are common. In length, these saws vary from 40 to 60 ft. They travel at the rate of about 1½ miles a minute, which is faster than the swiftest express train.

The great demand for American saws, for they are now sent to all parts of the world, is due not only to their form, but to the peculiar excellence of their steel. Saws were once imported exclusively from Europe, and even after the industry of making them was started here, the metal came from abroad.

Technical men have done much to perfect saw steel, but the sawmakers have also done a great deal to help themselves in getting the raw materials which suited their requirements. The success of such makers as Henry Disston is a case in point. Disston was a mechanic in Philadelphia, working in a small shop where saws were made. When the concern failed, he took it over in payment of a claim for wages, and without any capital built the great house which now bears his name. He realized that the quality of the steel available was not what he wanted, and therefore, in 1855, started a small works of his own where he made crucible steel. The product was so good that other industries asked him to sell them some. Thus, to this day, the firm has a large steel trade independent of its main business, which is that of making notched cutting tools.

Another famous firm of saw makers, the Simonds Manufacturing Company, of Fitchburg, Mass., has a steel plant of its own where it makes high-quality material for its goods. Saw steel must have qualities different from those required in other cutting instruments or in chopping tools, because the heat from the friction must be considered in the operation of the saw. It is a delicate question to determine when steel of this character is too hard or too soft, and what ductibility it should have. In most American saw steels, there is from 8 to 18 per cent of tungsten. Saw makers have secret processes and formulas which they guard jealously, as competition among them for the trade of the 30,000 sawmills in this country, to say nothing of an extensive foreign market, is very keen.

The Planer. While the saw plays the initial part of shaping the rough logs into lumber, it is to the planing machine that the refinements of woodworking are due. Its rapidly revolving cutter head reduces the uneven thickness of the lumber to an exact gauge, and simultaneously imparts the fine smooth surface. The planing machine is organized in various shapes for different uses. When the cutters are straight and arranged horizontally, it is a simple planer; when the cutters are short and arranged to work on the edge of the board, they are known as jointers; when the edges are cut into tongues and grooves, it is called a matching machine, and when the cutters have a curved ornamental contour, it is known as a molding machine or shaper.

In 1779, the British Government sent General Samuel Bentham to the northern cities of Europe to look over and report upon ship building, and other industries. While engaged on this mission, he invented the first planing machine, or planer, as it is called. This first machine of Bentham's was a reciprocating one, with a patent date of 1791. The invention consisted of a plane made like a hand plane, only larger, and this was worked by a power driven, reciprocating arm. It is claimed that this was the earliest operative machine for smoothing the surface of wood and planing it down to specified dimensions.

General Bentham, in English patent No. 1,838 of 1791, described a rotary form of planer along with a great variety of other woodworking machinery.

Bramah's planer, British patent No. 2,652, of 1802, was about the first planing machine of the nineteenth century. It is known as a transverse planer, the cutters revolving in a plane parallel with the upper surface of the board.

The planing machine of Muir, of Glasgow, British patent No. 5,502, of 1827, was designed for making boards for flooring, and represented a considerable advance in the art.

With the greater wooded areas of America, the rapid growth of the young republic, and the resourceful spirit of its new civilization, the leading activities in woodworking machinery were in the second quarter of the nineteenth century transferred to the United States, and a phenomenal growth ensued. Conspicuous among the early planing machine patents in the United States was that granted to William Woodworth, December 27, 1828. This covered broadly the combination of the cutting cylinders, and rolls for holding the boards against the cutting cylinders, and also means for tonguing and grooving in one operation. Parallel blades on cylinders for cutting wood were known as early as

1776, but who the original inventor of this great device was, has not been recorded in history. Bentham had also used the revolving cutting cylinder thirty-five years before the date of Woodworth's patent. In 1811, Charles Hammond, of London, invented a machine for sawing wood, which included a pair of feed rolls for moving the lumber or other pieces of wood along. Thus, the two necessary elements of a successful rotary-cutter planing machine had been invented, but not combined. Woodworth did not employ rolls for feeding, as a rack and pinion were provided for that, but his rolls had a coactive relation with a planer cylinder, or cutter head, in holding the board against the tendency of the cutter head to pull the board toward it. A patent was granted to Woodworth for these two features in combination, which patent was reissued July 8, 1845, twice extended, and for a period of twenty-eight years from its first grant, exerted an oppressive monopoly, since it covered the combination of the two necessary elements of every practical planer. Since both of the above elements had been invented independently, it was claimed by makers who attacked his patent that such a combination did not constitute a real invention, and that it was so obvious it would, of necessity, have been made by someone else, but in every case the courts upheld the validity of the Woodworth patent.

Following the Woodworth patent, came a host of minor improvements, among which were the Woodbury patents, extending through the period of the third quarter of the nineteenth century, and prominent among which is the patent to J. P. Woodbury, April 20, 1873, covering broadly a rotary cutter head combined with a yielding pressure bar to hold the board against the lifting action of the cutter head. Since that time there has been no major change. The planer of today, in its action and principle, is substantially the same as that of 1880.

The Lathe. This machine has come down to us directly from the bow drill, which goes back as far as history. From the bow drill were evolved the ancient "bow and cord" lathe, and the "pole lathe" which was the first foot-power lathe, and in both of these machines a forward and backward rotary motion was given by the alternate movements of the cord. A big improvement in the lathe was made when the piece of wood to be turned was placed horizontally between a pair of centers; then one end of the cord, which was wound in a couple of turns around it, was fastened to the face end of a pole and the other end fixed to a beam or upright. The lower end of the cord was then secured to a treadle or other piece of wood, so that it could be worked by foot power.

To this ancient art Thomas Blanchard, of Massachusetts, added in 1818, his very ingenious and important improvement for turning irregular forms. A few efforts at irregular turning had been made before, but generally only circular forms had been turned. With Blanchard's improvement, patented January 20, 1920, any irregular form, such as a shoe last, gunstock, ax handle, wheel spokes, etc., could be smoothly and expeditiously turned and finished in any required shape. In the ordinary lathe, the work is revolved rapidly, and the cutting tool is held stationary, or only slowly shifted in the hand. In the Blanchard lathe, the work is hung in a swinging frame, and turned very slowly to bring its different sides to the cutting action, and the cutting tool is constructed as a rapidly revolving disk, against which the work is projected bodily by the oscillation of the swinging frame, to accommodate the irregularities of the form. In order to do this automatically, a pattern or model of the article to be turned was also hung in the swinging frame, and made to revolve slowly and bear against a pattern wheel, which, acting upon the swinging frame carrying the work, caused it to advance or to recede from the cutting disk exactly in proportion to the contour of the model, and thus cause the revolving cutters to cut the block as it turns synchronously with the model, to a shape exactly corresponding to said model. This is one of the cleverest inventions ever made in woodworking machinery, since it is in no sense an improvement on any pre-existing machine.

Among later developments may be mentioned the patents to Kimball, March 15, 1892, and May 23, 1893, the latter showing ingenious means whereby shoe lasts of the same length, but varying widths, may be turned. A polygonal-form lathe is shown in patent to Merritt, 1893; a multiple lathe in patents to Albee, 1890 and 1895; a tubular lathe patent to Lonhart, 1887; and a spiral-cutting lathe in patent to Mackintosh, January 15, 1889.

Where a large number of irregular shapes have to be turned out at a time, such as spokes or hubs for vehicles, the "automatic profile lathe" is used. While this machine is based on Blanchard's invention, wonderful improvements have been made by Gleason and others, until now it is a highly efficient and remarkable machine.

Mortising Machine. This machine has exercised an important influence in millwork in the joining of the stiles in doors, sashes, and blinds, and in the making of furniture. A great impetus was given to the woodworking industry by General Bentham when he patented his self-acting mortising machine, in 1793.

Brunel's mortising machine for making ship's blocks is another early form described in the British patent No. 2,478, of 1801.

As representing novel departures, may be mentioned the endless chain mortising machine by Douglas, in 1888, and the patents on mortising augers to Appenheimer, 1885, and Charlton, 1891.

Boring and Dovetailing Machines. General Bentham, often quoted as the father of woodworking machinery, is again responsible for the inventive genius behind these machines. His patents on both boring and dovetailing machines were filed in 1793.

The boring machine is clearly based on the principles of the lathe, but to apply the necessary pressure to the bit while the boring operation is going on, and then automatically raise the bit after the hole is bored, requires a considerable amount of ingenuity. The chief improvements that have been made in recent years are to be found in the designs and the more accurate workmanship employed in making them.

Veneer-Cutting Machines. The first veneers, or thin slices of wood used for covering or decorating other surfaces, were cut by hand. The first machine for the purpose made use of a saw. This type is still in use, and it cuts the best veneers for the reason that the grain and color of the wood are preserved, although there is a great deal of wood wasted in cutting. In 1793, Bentham invented the "slicing veneer cutter," and as this is far more economical than the sawing cutter, it is widely used at the present time. To make sliced veneers, the wood block must be steamed first and then clamped in a frame, when thin sheets are sliced off by a reciprocating knife that cuts obliquely through the block.

Special Woodworking Machines. Of these there have been great numbers and variety. No sooner does an article become extensively used than a machine is made for turning it out automatically. Indeed, machines for cheaply turning out articles have, in many cases, led the way to popular use of the article because of the extreme cheapness of its production.

Among various automatic machines for making special articles may be mentioned those for making clothespins, scooping out wood trays, pointing skewers, dovetailing box blanks, cutting sash stile pockets, cutting and packing toothpicks, making matches, duplicating carvings, and thousands of others.

Extent of Woodworking Industry in the United States. It is impossible to give in any brief review a proper conception of the immensity of the woodworking industry in the United States. It was estimated by the Patent Office, in 1900, that about 8,000 patents had been granted for woodworking

machinery. Besides these there were about 5,000 patents for the separate class of wood sawing, about an equal number for wood-working tools. These, with other patented inventions in wood turning, coopering, wheelwrighting, and other minor classes, give some idea of the activity in this great field of industry.

The lumber industry of America is so big that it is almost impossible to comprehend its size. About 30,000 sawmills that now operate in this country turn out something like 40,000,000 board feet of lumber each year (Figures for 1923). This amount of lumber would load 1,600,000 railroad cars, and if made up in a single train would reach two thirds around the world. In addition to sawmills there are about 75,000 other wood-using establishments at work utilizing the wood that is taken from our forests, and making it into useable household and factory products. We are a nation of wood users. Perhaps no other people use so much wood as we do. It ministers to our wants continuously from the cradle to the coffin. It supplies us with countless conveniences and many necessities, from toothpicks, shoe pegs, and matches to big buildings and factories, and machines are the link which makes all of these things possible.

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Predicting Trade-School Success—V

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The fifth part of this study covers the relation of achievement in former schools to the achievement in the Vocational High School.

Relation of Achievement in Former School, Elementary, Junior High, or Senior High, to Achievement in the Clifford B. Connelley Vocational High School

The findings in other parts of the study on the relation between success in classwork and success in shopwork in the vocational high school showed a relationship existed between classwork and shopwork that had predictive value. As we are interested in finding predictive factors that are discernible before the boy enrolls in the Clifford B. Connelley Vocational High School, the former school-achievement records need be examined to determine whether they contain these predictive factors.

With this in mind, consideration is given to the following questions:

1. Is there any relation between the academic teachers' marks in the former school with the academic teachers' marks in the vocational high school in the subjects of English, science, and mathematics?

2. Is there any relation between the academic teachers' marks in the former school in English, science, and mathematics with the shop teachers' marks in the vocational high school?

3. Is there any relation between the industrial-arts teachers' marks in the former school with the shop teachers' marks in the vocational high school in the subjects of drawing and shopwork?

4. Is there any relation between the former teachers' marks in English, science, and mathematics of those dropping out before the end of the first semester and those staying in the vocational high school one or more semesters?

5. Is there any predictive value in former school teachers' marks in the subjects of English, science, and mathematics, shopwork, and intelligence when combined into a formula?

A General Statement Regarding Method

The data for this part of the study were difficult to obtain due to the fact that some records were not forwarded to the Clifford B. Connelley Vocational High School. The missing records were obtained, in as many cases as possible, through messenger service, telephone, and mail service. A number of records were unavailable due to reasons such as: lost records, change in supervisory officers and transfers from school to school that were not recorded. Some records although available were of no value in this part of the study because pupils had not been scheduled for the subjects that were being investigated. These various reasons account for the differences in the number of cases in this part of the study and the number of cases used elsewhere in this study.

The relations between achievement records in class- and shopwork in the former school, and the achievement records in class- and shopwork in the vocational high school are shown by means of correlations and probability tables.

Relation of Achievement in the Academic Subjects of English, Science, and Mathematics in the Former School to the Same Subjects in the Vocational High School

The correlation between former school and trade school teachers' marks in the combined subjects of English, science, and mathematics is +.269 with a probable error of .034.

It was shown earlier in this section, Chart No. 4, and Table XXV, that the size of the "r" conceals certain relationships. It was shown that when the same data were arranged in the form of a probability table, relationships were made more apparent and could be used for prediction. In view of these findings, the probability method was used for showing the relationships between former school-achievement records.

These relations of English, science, and mathematics in former school with the same subjects in the trade school are shown in the form of probability tables and will be found in the original thesis.

Table XXVII is a copy of one of these tables and is used as a sample for discussion.

This table shows the relation between former school teachers' marks in science with the trade school teachers' marks in science. The percentage of cases in each level, expressed in terms of chances in one hundred, are:

1. A boy making an A or B in former school would have:
   - 43 chances in 100 of making an A or B in the vocational high school
   - 38 chances in 100 of making a C in the vocational high school
   - 19 chances in 100 of making a D or E in the vocational high school
2. With a mark of C, his chances are:
   - 27 chances in 100 of making an A or

B in the vocational high school
39 chances in 100 of making a C in the vocational high school
34 chances in 100 of making a D or E in the vocational high school

3. With a mark of D or E his chances are:
14 in 100 of making an A or B in the vocational high school
45 in 100 of making a C in the vocational high school
41 in 100 of making a D or E in the vocational high school

37 in 100 of making an A or B in shopwork
47 in 100 of making a C in shopwork
16 in 100 of making a D or E in shopwork

3. With a D or E mark, his chances are:
33 in 100 of making an A or B in shopwork
43 in 100 of making a C in shopwork
24 in 100 of making a D or E in shopwork

This table, as well as the other probability tables, shows a consistent agreement in that the boy with an A or B in former school subjects has better chances of making an A or B in the vocational-high-school subjects than if he made a C, D, or E.

Tables XXIXa and XXIXb show in abbreviated form the relation between former teachers' marks in classwork and teachers' marks in shopwork in the vocational high school.

The numbers are read as so many chances in one hundred.

Tables XXX and XXXI show in abbreviated form the relation between teachers' marks in the industrial-arts subjects of shopwork and mechanical drawing to teachers' marks in shopwork in the vocational high school.

The numbers are read as so many chances in one hundred.

Relation of Achievement in the Academic Subjects of English, Science, and Mathematics in the Former School to Achievement in Shopwork in the Vocational High School

The relationship of achievement in the academic subjects in the former school to achievement in shopwork in the trade school is shown in the original study.

Table XXVIII is a copy of one of these tables and is used as a sample for discussion.

This table shows the relation between former school teachers' marks in the subject of mathematics and the vocational-high-school teachers' marks in shopwork, and is read as follows:

1. A boy making an A or B in mathematics in his former school would have:
49 chances in 100 of making an A or B in shopwork
41 chances in 100 of making a C in shopwork
10 chances in 100 of making a D or E in shopwork

2. With a mark of "C" his chances are:

Relation of Achievement in the Academic Subjects of English, Science, and Mathematics in the Former School to Dropouts Before the End of the First Semester in the Vocational High School

This study would not be complete without some attention being directed to the group that dropped out of school before the end of the first semester. The question is raised: What kind of teachers' marks did they have in the academic subjects of English, science, and mathematics in their former school?

To obtain an answer to this question, the cards of all boys who dropped out of the trade school before the end of the first semester for the five-year period, 1930 to 1935, were examined. These cards were limited to those boys transferred from the high schools, as the parochial and elementary schools do not forward a transcript of teachers' marks with the transfer card. The transcript records of 142 of these cases were located and the teachers marks in English, mathematics, and science for the last two semesters were given numerical values and averaged. The percentages for each teachers' mark level were computed with the results shown in Table XXXII.

This table shows that in the combined subjects of English, science, and mathematics approximately 90 per cent of the 142 boys who dropped out of school before the end of the first semester made a D or E in these former school subjects and less than 3 per cent made an A or B in these subjects. This is in spite of the fact that the emphasis in the vocational high school is placed on shopwork, rather than on the academic work in which they made poor marks in their former school.

Predictive Value of Former School Teachers' Marks in English, Science, Mathematics, Shopwork, and Intelligence When Combined Into a Formula

The relationships of intelligence, shop

TABLE XXVII

CHANCES FOR PLACEMENT IN THE A-B-C-D-E LEVEL OF TRADE SCHOOL TEACHERS' MARKS IN SCIENCE OF BOYS WHO HAVE EARNED AN A-B-C-D-E MARK IN SCIENCE IN THEIR FORMER SCHOOL

Trade School Teachers' Marks in Science	Former School Teachers' Marks in Science: A and B %	A and B N	C %	C N	D and E %	D and E N	Total
A and B	42 7	61	26.7	82	13.8	48	191
C	37 6	54	39 5	121	45.5	159	334
D and E	19 5	28	33.6	103	40.6	142	273
Total		143		306		349	798

TABLE XXVIII

CHANCES FOR PLACEMENT IN THE A-B-C-D-E LEVEL OF TRADE SCHOOL TEACHERS' MARKS IN SHOP WORK OF BOYS WHO HAVE EARNED AN A-B-C-D-E MARK IN MATHEMATICS IN THEIR FORMER SCHOOL

Trade School Teachers' Marks in Shop Work	Former School Teachers' Marks in Mathematics: A and B %	A and B N	C %	C N	D and E %	D and E N	Total	%
A and B	48.7	87	36.9	119	33.5	213	419	36.0
C	40.7	73	47.2	152	42.8	272	497	42.9
D and E	10.5	19	15.8	51	23.6	150	220	21.0
Total		179		322		635	1136	

TABLE XXIXb

Trade School Teachers' Marks in Shop Work	Former School Teachers' Marks in Science: A or B	C	D or E
A or B	45	38	29
C	45	43	43
D or E	10	19	28

TABLE XXIXa

RELATION, EXPRESSED AS CHANCES IN ONE HUNDRED, OF FORMER SCHOOL TEACHERS' MARKS IN ENGLISH, SCIENCE, AND MATHEMATICS TO SHOP TEACHERS' MARKS IN THE TRADE SCHOOL

Trade School Shop Teachers' Marks	Former School Teachers' Marks in English: A or B	C	D or E
A or B	45	41	30
C	41	44	47
D or E	14	15	23

TABLE XXX

RELATION, EXPRESSED AS CHANCES IN ONE HUNDRED, OF FORMER SCHOOL TEACHERS' MARKS IN DRAWING AND SHOP WORK TO TRADE SCHOOL SHOP TEACHERS' MARKS

Trade School Teachers' Marks in Shop Work	Former School Teachers' Marks in Mechanical Drawing: A or B	C	D or E
A or B	43	34	41
C	44	47	37
D or E	13	19	22

TABLE XXXI

Trade School Teachers' Marks in Shop Work	Former School Teachers' Marks in Shopwork: A or B	C	D or E
A or B	52	36	28
C	37	47	43
D or E	11	17	29

teachers' marks, and the combined, averaged teachers' marks in English, science, and mathematics in former school, to shop teachers' marks in the vocational high school, have been shown when treated separately. We need to know what combinations of these will select from the group of applicants, those most likely to succeed in shopwork in the vocational high school.

To obtain this information, the same former school records shown in Tables XXVII to XXXI were used. The number of boys, however, is limited to those having complete records in the following items: I.Q. records, teachers' marks in shopwork, and teachers' marks in English, science, and mathematics. As I.Q. records and shopwork were not available from the parochial-school records, and as the records of boys from the elementary school are shown as a general scholarship mark only, the number of cases is, therefore, limited to 518 boys from the junior and senior high schools.

As we are interested in obtaining criteria upon which selection of applicants to the vocational high school can be made, it was desirable to find what combination of these averages, when expressed as a formula, would discover the largest number of boys making A or B teachers' marks in shopwork in the vocational high school and the smallest number of boys making D or E marks.

Table XXXIV shows seven combinations of these three factors: former school-shop teachers' marks; for school teachers' marks in the combined subjects of English, mathematics, and science, and I.Q. ratings.

From Table XXXV the following four formulas have been chosen to use as a basis for selecting entrants to the trade school. These four were chosen as they select the highest ratio of boys making A and B marks in shopwork, to those making D and E marks.

Formula A discovers 30 boys out of 100 making an A or B mark in shopwork but includes 7 boys making a D and E mark.

Formula B discovers 32 boys out of 100 making an A or B mark in shopwork but includes 10 boys making a D and E mark.

Formula C discovers 41 boys out of 100 making an A or B mark in shopwork but includes 15 boys making a D and E mark.

Formula D discovers 60 boys out of 100 making an A or B mark in shopwork but includes 31 boys making a D and E mark.

This means that if the number of vacancies in the vocational high school should be known, and the number of applicants rating from 95 to 90 likewise increased the proportion of D and E boys.

TABLE XXXII

DISTRIBUTION OF FORMER SCHOOL TEACHERS' MARKS IN THE SUBJECTS OF ENGLISH, SCIENCE, AND MATHEMATICS FOR DROP-OUTS BEFORE THE END OF THE FIRST SEMESTER IN THE TRADE SCHOOL

Subjects	A and B %	A and B N	C %	C N	D and E %	D and E N	Total
English	2.8	4	16.9	24	80.2	114	142
Science	4.2	6	16.2	23	79.5	113	142
Mathematics	2 8	4	23.9	34	73.2	104	142
Combined English Science, Mathematics	2 1	3	8 4	12	89.4	127	142

TABLE XXXIIIa

COMPARISON OF AVERAGES OF FORMER SCHOOL TEACHERS' MARKS IN SHOP WORK IN THE COMBINED SUBJECTS OF ENGLISH, SCIENCE, AND MATHEMATICS, AND INTELLIGENCE WITH SHOP TEACHERS' MARKS IN THE TRADE SCHOOL

Trade School Teachers' Marks of A or B in Shop Work—Group 1

Former School Shop Averages	Eng. Sc. Math. Averages	I.Q. Averages	N
3.74 (A and B)	1.87	102.5	73
2.28 (C)	1.80	99.6	79
1.01 (D and E)	1.28	94.3	24
Average 2.71	1 75	100.0	Total 176

TABLE XXXIIIb

Trade School Teachers' Marks of C in Shop Work—Group 2

Former School Shop Averages	Eng. Sc. Math. Averages	I.Q. Averages	N
3.22 (A and B)	1.63	91	66
2.18 (C)	1.64	92	120
1.35 (D and E)	1.16	88	56
Average 2.27	1.52	90.7	Total 242

TABLE XXXIIIc

Trade School Teachers' Marks of D or E in Shop Work—Group 3

Former School Shop Averages	Eng. Sc. Math. Averages	I.Q. Averages	N
3.22 (A and B)	1.77	93.0	19
2.27 (C)	1.31	95.4	49
1.00 (D and E)	1.13	92.0	32
Average 2 04	1.33	93.8	Total 100

TABLE XXXIV

COMBINATIONS OF THREE FACTORS USED AS CRITERIA FOR SELECTING TRADE SCHOOL APPLICANTS

Combination Number	Former School Shop Teachers' Marks—Averages	Former School Teachers' Marks —English, Sci., Math.—Averages	I.Q. Ratings
1	2.50 and above	1.75 and above	95 and above
2	2.50	1.25	95
3	2.50	1.75	90
4	2.50	1.50	90
5	2 00	1.50	90
6	2.00	1.25	90
7	2 00	1.00	90

TABLE XXXV

NUMBERS, PERCENTAGE, AND RATIO OF A AND B SHOP BOYS AND D AND E SHOP BOYS DISCOVERED THROUGH THE USE OF COMBINATIONS OF THE THREE SELECTIVE FACTORS: FORMER SCHOOL SHOP TEACHERS' MARKS, FORMER SCHOOL TEACHERS' MARKS IN THE COMBINED SUBJECTS OF ENGLISH, MATHEMATICS, AND SCIENCE; AND I.Q. RATINGS

Combination	Selected From A and B Group 1 %	Selected From A and B Group 1 N	Selected From D and E Group 3 %	Selected From D and E Group 3 N	Ratio of % Selected From
1	30.28	53	7.00	7	4.32*
2	39.77	70	15.00	15	2.65
3	32.95	58	10.00	10	3.29*
4	41.47	73	15.00	15	2.76*
5	51.13	90	27.00	27	1.89
6	60.22	106	31.00	31	1.94*
7	66.47	117	43.00	43	1.54

*These combinations used as Formulæ A, B, C, and D, respectively in Table 36

Tables XXXIIIa, XXXIIIb, and XXXIIIc, show these 518 cases divided into three groups, based on averages of teachers' marks in shopwork in the trade school: Group 1, A and B marks; Group 2, C marks; and Group 3, D and E marks. Averages are shown for I.Q. ratings and former school teachers' marks in English, science, mathematics, and shopwork.

These tables show that when comparing the vocational-high-school Group 1 with the trade-school Group 3, the averages in the former school shop, the averages in English, science, and mathematics, and the I.Q. ratings are lower in the Group 3 than in Group 1. There is apparently some relationship between success in the trade-school shopwork and prior school records, as shown in these averages that justifies further investigation.

These combinations show that if former school-shop marks are lowered, a larger number of D and E boys are selected; there is, therefore, no advantage in continuing a decrease in these values. As the former school teachers' marks in the combined subjects of English, science, and mathematics are lowered, a larger number of D and E boys are selected; there is, therefore, no advantage in continuing a decrease in these values. Lowering the I.Q. rating from 95 to 90 likewise increased the proportion of D and E boys.

To obtain an enrollment that included boys making a C mark in shopwork in the vocational high school, formulas A, B, C, and D were used in discovering boys from

(Continued on page 70)

INDUSTRIAL ARTS and VOCATIONAL EDUCATION
J. J. Metz, Editor

Industrial Arts and Vocational Education and Industry

It was the writer's privilege recently to make an extended trip through a large plant where a great variety of heavy machinery is produced. Time for the trip was all too short to cover the entire plant, hence the visit was confined to but one department. The value of the trip was greatly enhanced by the fact that the man directly responsible for the installation and maintenance of the department visited, acted as guide.

The first thing to impress the visitor were the evidences of careful planning clearly apparent on all sides. The needs of the workers on the assembly line, for instance, had not only been carefully studied but every aid that could be given them to handle their work easily and efficiently was provided. Where heavy pieces had to be handled, lifting devices of various sorts were ready to hand. In most cases, these had been so designed that the worker did not have to exert a force of more than ten pounds to put the piece on which he was working into its proper place.

One frequently hears that the men on the modern assembly lines must work at a killing pace, that they must keep at their work without a moment's let up, that their faces display the fatigue which the inhuman driving and the monotony of their work produces. Most teachers engaged in the fields of industrial arts and vocational education know that there is but little truth in many of these statements. They know that in general, this assembly work on the line is no more monotonous than is the work on a production machine. As a matter of fact, many production men and line assemblers get a great deal of job satisfaction out of their work. Of course, this satisfaction may be quite different from that enjoyed by the toolmaker engaged in the construction of a complicated jig. A very large percentage of the men engaged in industrial work are quite content to do routine work. Many of them would be decidedly unhappy and uncomfortable were any independent work expected of them.

All of the men observed on this shop trip, while they were working steadily, seemed quite unhurried. Naturally, their every action showed that it had been planned. There was no lost motion. Each tool, when it had served its purpose, was immediately returned to the same place, to be ready when next it would have to be used again.

When all of the many parts had finally been assembled, the finished unit was automatically carried through a closely hooded compartment and thoroughly cleansed with hot water sluiced on under high pressure. After a short trip through a drying chamber, it was ready to receive a spray coat of bright finishing lacquer.

Again the effects of careful planning were apparent. With almost machinelike regularity, the men operating the spraying machine hung their spray nozzles aside as each new unit arrived at their station, and with a few deft movements, slipped special rubber protectors over all parts that were not to be covered with lacquer. Then, quickly, but thoroughly, the finish was sprayed on, and the unit moved forward through a drying compartment from which it presently emerged ready to be given a short test, after which it was immediately rolled onto a flat car. Here it was carefully fastened in place, ready for shipment at the end of the day.

In the same building where the assembling was being done, there were machine tools upon which some of the parts needed in the assembly are machined. Some of these machine tools are quite large and many of them were especially built to do a specific piece of work. The jigs used on these machines are exceedingly ingenious. In at least one case, the jig was so built that two dissimilar parts which are to be used together are finished at the same time in the same jig. All of the machining is done to fine limits, in some cases the tolerance being a tenth of a thousandth.

There were many other indications of careful planning. For instance, some of the units used on the assembly line came securely packed in large cartons. As these units were taken out of their wrappings, the empty cartons were immediately discarded into gondola freight cars so that this debris could be taken out of the shop each evening at the same time that the assembled machines were taken out on their flat cars.

A specially designed machine also had been provided to pulverize and thoroughly cleanse the huge mass of steel chips which were produced by the production machines each day, thus turning them into a salable material which could be readily loaded and transported.

Throughout this trip, the writer could not help but feel regret that the very interesting picture which was unfolding before him could not also be viewed by the many individuals who still feel that the schools need not take cognizance of the fact that millions of people could be more economically prepared by the schools for their future life activities, if they were given a greater insight into the knowledges and skills which will be demanded of them when they enter the workaday world.

Such a trip might also show those educators who are still obsessed with the idea that industrial arts and vocational education is to be recommended especially for the dull, and for those who seemingly do not fit into the academic curriculums, that industry needs and employs many people who have the capacity and ability to do careful, analytical thinking, who possess skillful hands, who can plan and direct the work of others, and who are able to start an undertaking like the one described here and carry it through to a successful ending. They might also awaken to the fact that the man who designs the jigs, who works out the routine for all of the different operations, who plans the shops, orders the machine tools, decides on their location in the shop, orders and superintends the design and construction of the special machinery, must possess an intelligence equal to, if not of higher grade, than that required by the men who enter the fields of law, medicine, or education.

Those teaching in the fields of industrial arts and vocational education may well feel proud of the contribution which they make to general education. They must, however, recognize that theirs is also the responsibility of continually scrutinizing the work which they offer so that it may be kept in a constant state of flux. If that is done, industrial arts and vocational education will grow and be ever better able to prepare the 95 per cent of those who attend school, for the lives which they of necessity or of choice will have to live.

(Continued from page 64)

Group 2 (Table XXXVII). This group consists of 242 boys making a C in the trade-school shop.

Formula A discovers 31 boys
Formula B discovers 37 boys
Formula C discovers 48 boys
Formula D discovers 93 boys

Table XXXVII summarizes the findings when using formulas A, B, C, and D for discovery of boys in Groups 1, 2, and 3.

By including boys making a C mark in shopwork, Formula A will select 84 boys making a C or above in shopwork and include 7 D and E's; Formula B will select 95 boys making a C or above in shopwork and include 10 D and E's; Formula C will select 138 boys making a C or above but will include 27 boys making a D or E mark; and Formula D will select 199 boys making a C or above but will include boys making a D or E mark.

TABLE XXXVII

NUMBER OF BOYS DISCOVERED THROUGH THE USE OF FORMULAE A, B, C, AND D FOR GROUP 1, 2, AND 3

Formula	*Trade School Shop Teachers' Marks A and B Group 1 N—242*	*"C" Group 2 N—242*	*D and E Group 3 N—100*
A	53	31	7
B	58	37	10
C	90	48	27
D	106	93	30

TABLE XXXVI

FOUR FORMULAE FOR SELECTING APPLICANTS TO THE TRADE SCHOOL

Formulæ	*Averages of Former Shop Teachers' Marks*	*Averages of Former School Teachers' Marks in Eng., Sci., and Math.*	*I.Q. Ratings*	*Ratio of A and B Boys Discovered to D and E Boys*
A	2.50 and above	1.75 and above	95 and above	4.32
B	2.50 and above	1.75 and above	90 and above	3.29
C	2.50 and above	1.50 and above	90 and above	2.76
D	2.00 and above	1.25 and above	90 and above	1.94

Summary of Findings

1. Correlations between success in former subjects and success in trade-school subjects are low, but are positive and are reliable.

2. The probability tables show a boy has better chances of making A and B marks in the vocational-high-school subjects if he makes A and B marks in the same subjects in his former school. This applies to the subjects of English with English, science with science, mathematics with mathematics, and shopwork with shopwork.

3. The probability tables likewise show that with an A or B mark in the combined subjects of English, science, and mathematics in the former school, his chances are better than 3 to 1 of making an A or B mark in shopwork rather than a D or E.

4. The majority of the dropouts from the trade school before the end of the first semester came from the group making D and E marks in their former school subjects of English, science and mathematics. Only 2 per cent of this group made A or B, whereas, 89 per cent made a D or E in these subjects in their former school.

5. Better selection of applicants to the trade school may be made with the following combination of former school records:

a) An average teachers' mark of 2.50 or above in shopwork.

b) An average teachers' mark of 1.75 or above in the combined subjects of English, science, and mathematics.

c) An I.Q. rating of 95 or above.

This formula discovered 4.3 times as many boys making A and B marks in shopwork in the vocational high school as made D and E marks.

6. If the number of boys selected by this formula is too few to operate the school economically, then use Formulas B, C, and D in order until quota is filled.

7. It may be that certain shops do not require the same degree of intelligence or academic ability as others, or that the former school-shop experience is not a function of the shop in which the boy is enrolled in the Clifford B. Connelley Vocational High School, and that the formulas need to be changed to meet these needs. Unfortunately, the numbers of boys in each trade were too few to arrive at any conclusions. As the data were being tabulated there were some implications suggesting this possibility. This phase of the work deserves further consideration after the formulas are put to use for several years and when more data are available for the separate trades.

8. It was shown previously, that entering age and grade had some relation to success in shopwork. As the boy's entering age increased and his entering school grade became higher, his marks in shopwork became higher. The differences, however, in the means of the shop teachers' marks for varying age and grade levels were not large, nor were all reliable. It was shown that on the basis of these findings, a boy entering between 16 and 17 years of age and in the tenth grade, would make the best trade-school prospect as far as age and grade were concerned. It was also shown that entering age and grade needed to be varied to meet the requirements of certain trades.

Entering age and grade, therefore, need to be considered along with the prediction formula for selecting applicants for certain trades as noted.

9. Other factors, such as nationality and occupation of the father; hobbies and interests; personality traits and aptitudes; etc.; may also be factors contributing to the success of the boys in the trade school, but unfortunately, such records were not available and could not be obtained, as these boys are no longer enrolled in this school.

Some Comments and Inferences

Selection based on former school records of achievements raises the question of policy regarding the operation of the vocational high schools. Perhaps a statement on two forms of policies for the operation of the vocational high school is in order at this time.

a) If the vocational high school is to be held responsible for its output in terms of highly trained, skilled apprentices, it should admit only those who are most likely to succeed in trade work. This means the setting up of entrance requirements that will reduce the chances for failure to a minimum. It also means that those failing should be discontinued from training in the vocational high school upon evidence supporting these findings. This plan for admitting only those who have some reasonable chance for succeeding, and discontinuing those failing, would make for a highly selected group of trainees.

b) If the vocational high school is looked upon by the school authorities as a school organized to try out, to select, and to train from the many sent to it, only those having the physique, the intelligence, the aptitudes, and the interests for trade work, its role is quite different from that recommended by the Smith-Hughes Act. This Act implies that only those who can profit by the training offered be admitted.

It, of course, depends upon our interpretation of this "Act" relative to the phrase, "who can profit by the training offered." It is possible that many of the boys now in high school could profit more by the type of training offered in the vocational high school than by the type of training now offered in the other high schools. This, however, does not say that they will become skilled tradesmen, if transferred to the vocational high school. No doubt, this tryout in a variety of shop experiences, under proper direction and supervision, would be the means of solving some of these high-school problems dealing with the training of certain boys.

Irrespective of the policy adopted as to the organization and operation of the vocational high school, the findings of this study on the predictive value of former school achievement in classwork, intelligence, and shopwork should be of value. If selection of applicants is to be made prior to entrance to the vocational high school, then records such as age, grade, I.Q. ratings, and teachers' marks in classwork and shopwork with their predictive value are needed.

If selection is to be made at the close of the tryout period in some form of pre-trade-school work, then the relations between achievement in classwork (both academic and related) and achievement in shopwork is of value in counseling and in placing applicants to the vocational high school.

(To be continued)

Testing and Tests

TEST IN ELECTRICITY

T. L. Stanaway, West Junior High School, Lansing, Michigan

Following is a group of incomplete sentences. Read each sentence carefully, then fill in the word, or words, which will make it complete.

1. Two kinds of electrical connections are ..... and .....
2. For a simple doorbell system you need the following material: ....., ..., ..., and .....
3. In wiring up a doorbell system you could substitute a ..... for the dry cells.
4. To prevent moisture from getting at the wires, No. 18 wire is covered with .....
5. The electric meter has ..... dials.
6. The electric meter registers electricity in ..... hours.
7. In wiring up a doorbell system from front and back door we use a ..... for one door and a ..... at the other.
8. A dry cell can be tested with a .....
9. A push button can be tested by touching the ..... together that enter the push button.
10. The doorbell uses the ..... principle in its operation.

Number attempted ..... Number wrong ..... Score .....

BROADENING THE USE OF TESTS

O. L. Young, High School, Germantown, Ohio

The tests described in this article were set up to test objectively the student's knowledge of shop practices. The test, "Ability to Sharpen a Plane Bit," has as an objective not only to test the ability of the student to sharpen a plane bit but also to test his ability to determine when a plane bit needs to be sharpened and to determine when a plane bit is sharp. The test, "Ability to Use a Plane," has as an objective to test the ability of the student to use a plane correctly. Other tests would need to be added to these two depending on the subject matter covered in the course of study.

Structure of the Test

The content covered by each test was determined in the following manner. First, several textbooks on the subject were examined and from these a list was made. To this list were added items deemed necessary by the author as indicated by past teaching experience. The test was then reviewed by two experienced teachers for completeness and clarity. The test was then set up and given to students in the author's classes. This gave an added check on clarity. The final check for clarity, completeness, and accuracy was made by Professor R. E. Smith, Practical Arts Department, Ohio State University.

Test of Ability to Sharpen a Plane Bit

Directions: The list which follows, contains a number of problems which you meet in connection with the sharpening of a plane bit. To each problem there are listed three answers. You are to select the answer, from the three listed, which you think gives the *best* explanation of the problem and, also, the answer which you think gives the *poorest* explanation of the problem.

In checking, use the symbols listed: X — best; O — poorest.

Example:

Problem: A sharp plane bit should be used.

a) It does a better job. X *a*)
b) It makes planing easier work. _____ *b*)
c) The job is finished more rapidly. O *c*)

There are those who contend that the student should construct a good, a medium, and a poor solution for each problem instead of merely picking out the best and the poorest solutions from three or more given solutions. They contend that a student may be able to select the proper answer but cannot formulate the proper answer. If the test asks the student to make out his solution, it makes the scoring of the test more time consuming and places scoring on a subjective basis. Futhermore, it has been shown by the Bureau of Educational Research of Ohio State University that in many cases there is a high correlation between formulating the proper solution and picking out the proper solution. In view of the three facts listed above, it seems advisable to list the solutions and have the student select from them rather than have him formulate his own solutions.

Three solutions to each problem are used. This number gives a possibility of six answers which practically eliminates guessing and yet does not make grading tedious and time consuming. Two solutions would reduce the test to a true-and-false test which is losing popularity among educators. Four solutions would complicate grading as there would be twelve possible answers, but the main objection to four solutions is the fact that many problems do not provide four solutions. Furthermore, it has been found by the Bureau of Educational Research of Ohio State University that there is a high correlation in score between a three- and a four-solution test.

The student was asked to determine the best and the poorest solution to each problem instead of only the best. This permits six answers instead of three, when three solutions are listed, and thus reduces guessing. Furthermore, it is important that a student recognize a poor solution.

Grading of the Test

To each problem there are six possible answers as listed below:

Answer	*Score*
A. Best answered as best and poorest as poorest	5
B. Best answered as best and medium as poorest	4
C. Medium answered as best and poorest as poorest	3
D. Medium answered as best and best as poorest	2
E. Poorest answered as best and medium as poorest	1
F. Poorest answered as best and best as poorest	0

The score given at the right of the six possible answers is the score given each problem, according to the answer given. Everyone would agree that answer *A* deserves the top score and answer *F*, the lowest score. There may be some who contend that answers *B* and *C* should have an equal score, and also that *D* and *E* should have an equal score. The author has assigned different scores on the theory that it is more important that a student be able to select the best solution than it is that he be able to select the poorest solution.

Use of the Test

This test, like most tests, may be used to determine what the student knows about the particular subject or unit. To give the teacher this desired knowledge the test should be given at the close of the period of instruction on the particular unit or subject. When this has been done a grade is given the student. To determine the grade is at present the prime purpose for which tests are given. All too often, the determination of a grade is the only purpose for which a test is given.

A test should do more than merely determine the grade or what a student knows about a given unit or subject. This test if properly used should measure the efficiency of learning and the efficiency of teaching and indicate the points that need review or additional instruction.

Frequently a student demonstrates by the test that he knows a great deal about a given unit and thus receives a good grade. The good grade indicates that he has learned a great deal and therefore has profited by the instruction received. This same student may actually have learned very little from the instruction given. He might have known many of the things he now knows before starting the course of

instruction. The efficiency of his learning would thus, in reality, have been very low. The efficiency of learning can be determined by this test for each student. In order to do this, the test is given each student before instruction begins. Let us assume a certain student makes a score of 50 points out of the 250 points which it is possible to make. He then receives his instruction. At the close of the instructional period he is again given the test. This time he makes a score of 200 points. This shows he has made 150 points of progress out of a total of 200 points. This is an indication of his efficiency of learning.

The teacher can determine the points in which the entire class are low. He can then give additional instruction on these points to the class if time permits. This test enables him to pick out his weak and strong points of instruction. By so doing he should gradually improve his efficiency in teaching. The student can pick out his own weak points, which may be different from those of other students, and improve himself, individually, if he so desires.

The test used as described above becomes diagnostic for both teacher and student. In addition to being diagnostic, it indicates the efficiency of learning and of teaching. The latter can only be used after norms are established but all the other advantages of the test become available when the test is used in a single class.

GENERAL METALWORK TOOLS TEST

G. L. Simnicht, High School, Elk River, Minnesota

Directions: Write the name of the tool or part of the tool in the blanks.

1. Figure A shows a ..... hammer.
2. No. 2 in Figure A is the .....
3. No. 3 in Figure A is the .....

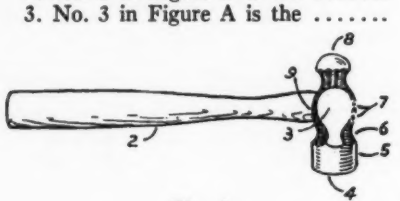


Fig. A

4. No. 4 in Figure A is the .....
5. No. 5 in Figure A is the .....
6. No. 6 in Figure A is the .....
7. No. 7 in Figure A is the .....
8. No. 8 in Figure A is the .....
9. No. 9 in Figure A is the .....

Fig. B

10. Figure B is a ..... chisel.

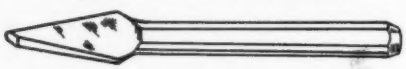


Fig. C

11. Figure C is a ..... chisel.

Fig. D

12. Figure D is a ..... chisel.
13. Figure E is a ..... chisel.
14. No. 14 in Figure E is the .....
15. No. 15 in Figure E is the .....
16. No. 16 in Figure E is the .....
17. No. 17 in Figure E is the .....
18. No. 18 in Figure E is the .....

Fig. E

19. Figure F is a ..... hammer.
20. No. 20 in Figure F is the .....
21. No. 21 in Figure F is the .....
22. No. 22 in Figure F is the .....
23. No. 23 in Figure F is the .....

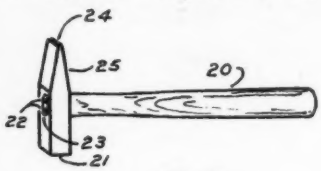


Fig. F

24. No. 24 in Figure F is the .....
25. No. 25 in Figure F is the .....
26. Figure G is a ..... drill.
27. No. 27 in Figure G is the .....
28. No. 28 in Figure G is the .....

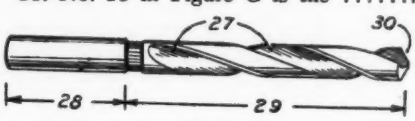


Fig. G

29. No. 29 in Figure G is the .....
30. No. 30 in Figure G is the .....
31. Figure H is a .....
32. Figure J is a .....

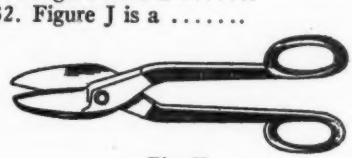


Fig. H

33. No. 33 in Figure J is the .....
34. No. 34 in Figure J is the .....
35. No. 35 in Figure J is the .....
36. No. 36 in Figure J is the .....

Fig. J.

37. No. 37 in Figure K is the .....
38. No. 38 in Figure K is the .....
39. Figure K is a .....

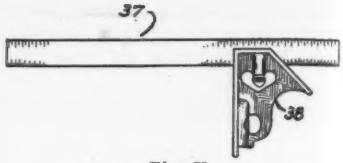


Fig. K

40. Figure L is a .....
41. Figure M is a .....

Perfect score is 41. Your score is .....

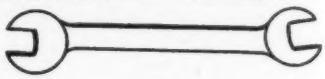


Fig. L

Fig. M

Key

1. Ball-peen	23. Eye
2. Handle	24. Peen
3. Cheek	25. Head
4. Face	26. Straight shank twist
5. Poll	27. Flute
6. Neck	28. Shank
7. Wedges	29. Body
8. Peen	30. Lips
9. Eye	31. Tin snips
10. Cape	32. Hacksaw
11. Round	33. Handle
12. Diamond-point	34. Frame
13. Flat	35. Blade
14. Cutting edge	36. Adjusting nut
15. Bevel	37. Rule
16. Angle	38. Sliding head
17. Stock	39. Combination square
18. Head	40. Machinist's wrench
19. Setting	41. Center punch
20. Handle	
21. Face	
22. Wedges	

WOOD-FINISHING EXAMINATION

Herbert K. Iverson, Lincoln High School, Seattle, Washington

Part I

Directions: In each of the statements below you will find a word that makes each statement false. When you have decided which word it is, cross it out and place the correct word on the space provided for it in front of the statement. In no case is the wrong word one of the first three words of the sentence. The example is answered correctly.

Example:

most 1. Water stain is the ~~least~~ desirable stain on the market at the present time.

..... 1. Dust particles left in the pores of the wood after the sanding operation should be removed with a damp cloth.

..... 2. The final sanding operation plus that of removing the dust should be done in the finishing room.

..... 3. A surface to be water stained should be sponged and lightly sanded after applying the stain.

..... 4. Oily rags, if enclosed in a fireproof container, aren't a fire hazard.
..... 5. Filler should be allowed to stand for one hour before removing the surplus.
..... 6. Any finish containing shellac makes an excellent material for covering floors.
..... 7. An oil stain should be sealed with a thick coat of shellac before applying lacquer.
..... 8. Filler should be applied with a soft bristle brush so as to insure the entry of the silex into the pores of the wood.
..... 9. Spirit stains are made by mixing powdered colors with alcohol.
.....10. A brush used in spirit stains is best cleaned in turpentine.
.....11. It is a good procedure to buy water stains prepared to insure the correct color.
.....12. The term "four-pound cut" means four pounds of shellac to four gallons of alcohol.
.....13. The final rubbing of a filled surface should be with the grain using a coarse cloth.
.....14. The more the filled surface is rubbed the less beautiful will be the finished article.
.....15. One coat of filler is usually enough, but another may be necessary on an open grain wood such as fir.
.....16. When the staining is being done on a vertical surface, begin at the top and work down at the same time brushing inward.
.....17. Lacquer is best applied lightly whether brushing or spraying.
.....18. The second coat of lacquer should be brushed thoroughly to insure binding the second coat with the first.
.....19. The first coat of varnish should be applied with a thick coat.
.....20. Varnish should be sanded between coats to remove the gloss.
.....21. A coat of varnish should be allowed to dry at least eighteen hours before applying another.
.....22. Rottenstone is a rubbing agent used to remove brush marks.
.....23. Pumice, if too much pressure is applied, will polish a coat of finish.
.....24. For rubbing purposes, pumice should be mixed with linseed oil.

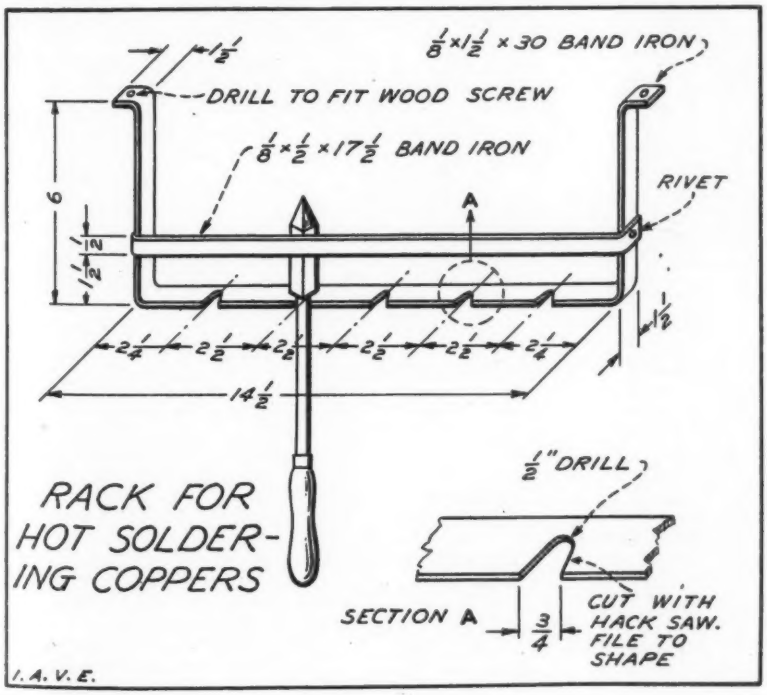
Problems and Projects

HANDY RACK FOR HOT SOLDERING COPPERS

Eugene W. Frank, Washington Junior High School, Jamestown. New York

The problem of what to do with hot soldering coppers is solved by the rack illustrated and described herewith. The rack may, of course, be modified to suit individual needs.

Safety from burns, and the avoidance of possible fires are desirable features of this rack. Fasten the rack under the soldering bench about 12 in. back of the working edge. The rack makes it possible to put away hot soldering irons immediately and at the very place they are placed — the soldering bench. Sufficient air space between the point of the iron and the bottom of the bench provides air insulation so that there is no danger of fire on this score.



SOLVING THE SANDPAPER PROBLEM

R. L. Grandle, Horace Mann Intermediate School, Wichita, Kansas

Sandpaper has always presented one of my greatest shop problems — how and when to issue it to the various students, and how to keep an accurate check of the amount used by each.

The *sandpaper card* described herewith has solved the problem very satisfactorily. One of these tickets is issued and charged to each student as soon as the classes are organized. The cards are kept in alphabetical order in a card file. One boy is then chosen from each class as the *sandpaper boy*. He serves for one semester and is excused from some of the routine jobs which are rotated among the students. Of course, the sandpaper boy must be an honest and businesslike individual. It has been found that it is much better to use one boy throughout the semester rather than have first one boy and then another responsible for the sandpaper.

1 2 3 4 5

16 Date..... Value..... 6

Horace Mann Woodwork Shop

15 SANDPAPER CARD 7

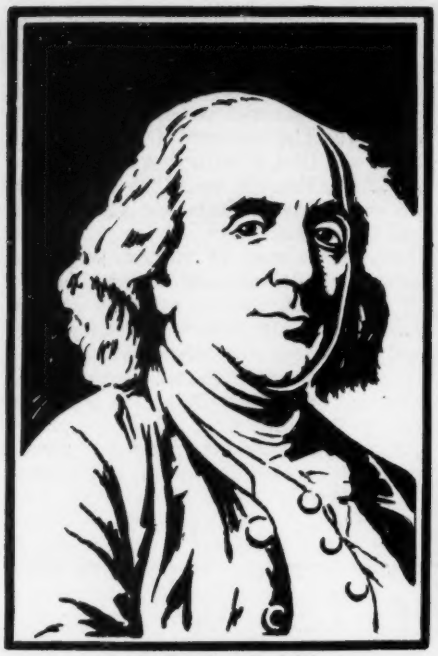
Name..... Class.....

14 Good For 16 Quarter Sheets of Sandpaper 8

13 12 11 10 9

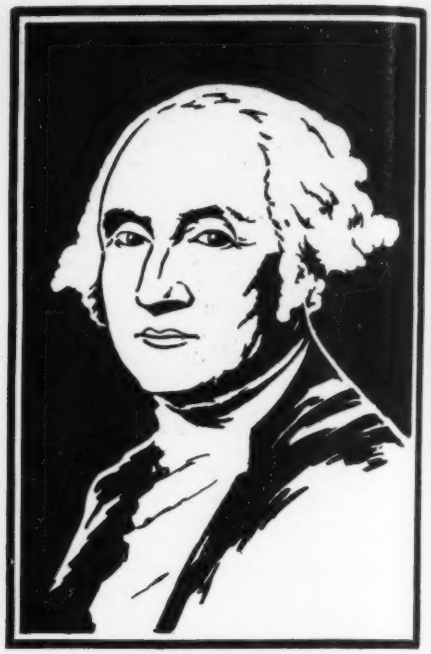
At the beginning of each class period, the sandpaper boy is given a key to the sandpaper-supply cupboard so that he may attend to his duties. When a student wants a piece of sandpaper, he goes to the card file and gets his sandpaper card, takes it to the sandpaper boy and tells him the size and amount of sandpaper that is ordered and with a paper punch punches the sandpaper card one time for each piece of sandpaper issued. The purchaser then replaces his card in the proper place in the card file.

This idea worked well in my woodwork class, but it may need some changes to fit the individual needs of someone else. The following changes may probably be found to be quite acceptable. Instead of using the sandpaper-card file, the students may be required to take care of the sandpaper cards in their bench drawers, or in some other convenient place. Instead of using a cupboard for the sandpaper supply, it may be more convenient to have a box large enough to hold



BENJAMIN FRANKLIN

ABRAHAM LINCOLN



GEORGE WASHINGTON

AMELIA EARHART

WILL ROGERS

CHARLES A LINDBERGH

a small amount of the more popular sizes of sandpaper. This might be placed on the sandpaper boy's bench and would save him much time and eliminate unnecessary confusion and running around.

BLOCK CUTS OF FAMOUS PEOPLE

May L. Lampe, Weehawken, New Jersey

Making block cuts of famous people is very interesting and can be developed into a very pleasing hobby. It requires practically no originality, but demands skill and a knowledge of suitable techniques.

Abraham Lincoln, George Washington, Benjamin Franklin, Will Rogers, Amelia Earhart, and Charles Lindbergh, have made indelible impressions upon us. The beginner may find it interesting to try his skill sketching their likenesses on linoleum, Parra, or Artcraft, and cutting them out.

The first requisite, of course, is an excellent reproduction of the portrait to be cut. Much energy and effort may be lost if time is spent on a poor likeness. A three-quarter view of a person throws shadows on one side of the face and gives a block cut more character than if a front view were used.

Draft a rough outline of the contour of the head and shoulders on paper the size of the desired block. Sketch in the features, using substantial black and white contrasts. Generally there are peculiarities about the great people, and these can be brought out with a bit of study. For instance, Lincoln, in formal attire, is usually represented with his tie on a downward slant on the right. Washington's mouth shows such determination that it becomes one line, showing only slightly the outline of the lips. Benjamin Franklin's left eye is much larger than the right. Lindbergh, as a rule, is shown with his arms crossed and looking upward. Will Rogers and Amelia Earhart usually are shown in sports togs.

After a good likeness has been accurately drawn, trace the picture on the block in reverse. The tracing will be more legible on a white surface. Therefore, the block may be coated with opaque white, and the drawing then transferred to it with carbon paper.

A portrait is so much more intricate in its cutting than a scene. Cutting off a line, no

matter how slight, might alter the likeness of the particular person being portrayed. While cutting the lines on the block, it may prove helpful to hang the picture which is being copied on the shade of a lighted lamp. Turn it in reverse. This may help in improving the work. Or, after using the tracing for the block, go over the lines on the tracing with a No. 2 Drawlet pen. Lay this tracing in reverse next to the block. This method saves time and patience. Take time to do good work. Do not spoil it with undue haste.

Use a fine veiner for cutting the outline of the face, features, and hair. The wide gouges can be used for the coat, background, and the larger areas. Be sure the tools are sharp. No artist can do good work with dull instruments.

SWITCHBOARD FOR STUDYING PARALLEL CIRCUITS

G. S. Ketiladze, Technical School, Ottawa, Ontario, Canada

The switchboard shown herewith furnishes an excellent opportunity for studying parallel circuits with three resistances. The method of wiring permits this to be done with but one voltmeter and one ammeter.

The resistances are connected to A1–A2, B1–B2, and C1–C2.

Switches XY and MN are up, i.e., open.

Switches EF, TU, PO, and RS are closed.

The voltmeter, the ammeter, and the rheostat are connected to the terminals marked Voltmeter, Ammeter, and Rheostat.

When the circuit is connected to the line the total current flows in the wire joining K to the minus line through the switch RS.

The current flowing through resistance A1–A2 flows through the switch TU.

The current flowing through resistance B1–B2 flows through the switch EF.

The current flowing through resistance C1–C2 flows through the switch PO.

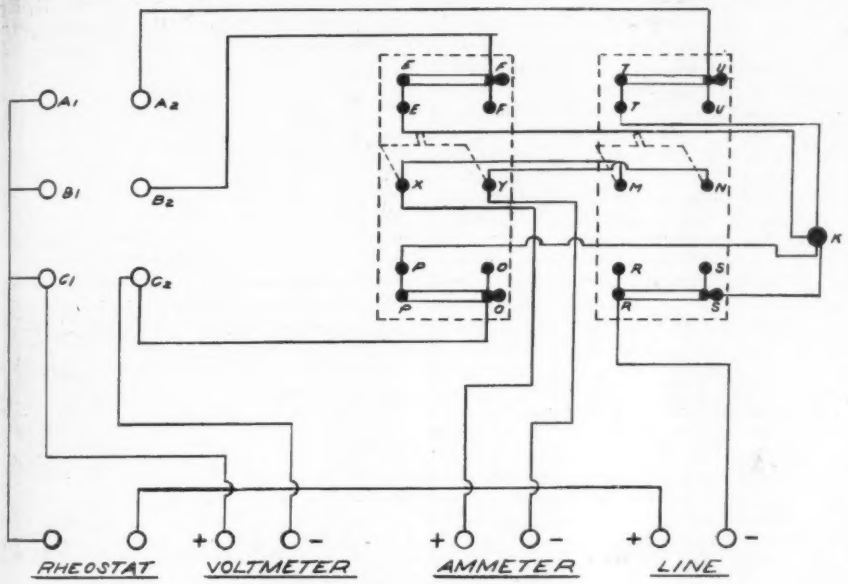
Now, if the switch MN is closed on RS, and the switch RS is open, the ammeter shall read the total current.

If the switch MN is closed on TU, and the switch TU is open the ammeter shall read the current through the resistance A1–A2.

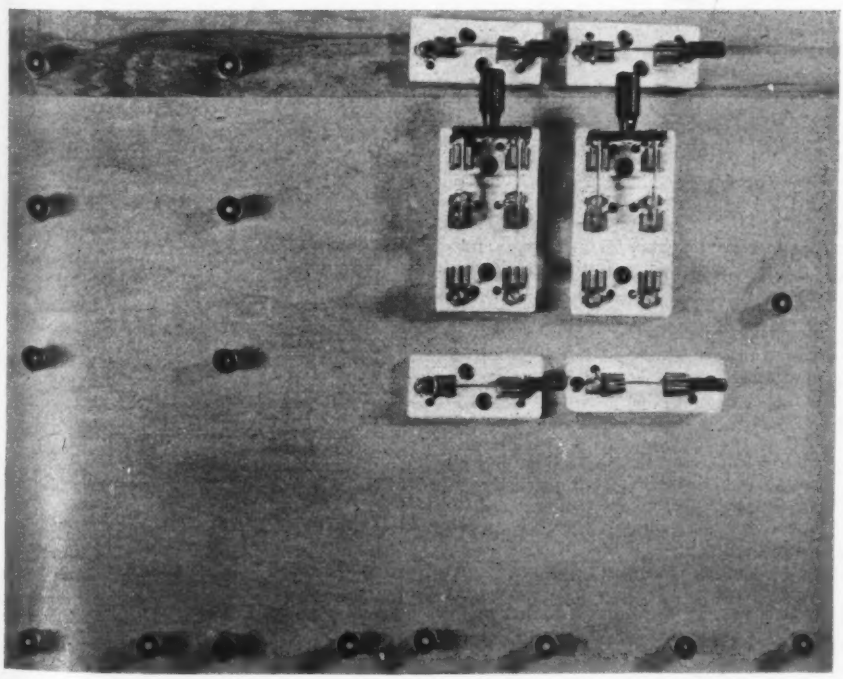
Similarly, if the switch XY is closed on EF, and switch EF is open the ammeter reads the current through the resistance B1–B2, and the ammeter reads the current through C1–C2 when the switch MN is closed on PO and switch PO is open.

The circuit could be made more compact than that shown on the diagram.

"K" is the common point. It is not really necessary as point S may be taken as common point. The reason for bringing out K is to provide a binding post in case an additional resistance is required for some other experiment.



Switchboard diagram

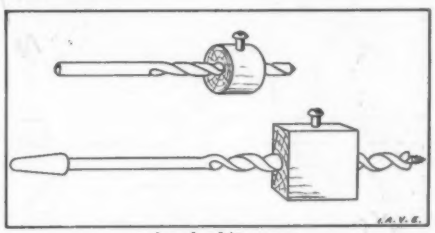


Switchboard

A HANDY BIT GAUGE

C. E. Beck, Lockport, New York

Frequently one has to bore a group of holes to a certain depth and lacks a gauge for doing so. Here is a kink that can be made in a jiffy to solve the problem and save valuable time.



A handy bit gauge

Any scrap piece of hardwood will do. For a small drill a section of a broomstick or large dowel will suffice. For larger holes, a larger block of hardwood will do. Bore into the end grain of the stock as this will prevent the wood from splitting. The setscrew may be of any convenient size that will reach through the side and against the drill or auger bit. No exact sizes are necessary as the drawing is self-explanatory.

MAKING MARIONETTE ANIMALS

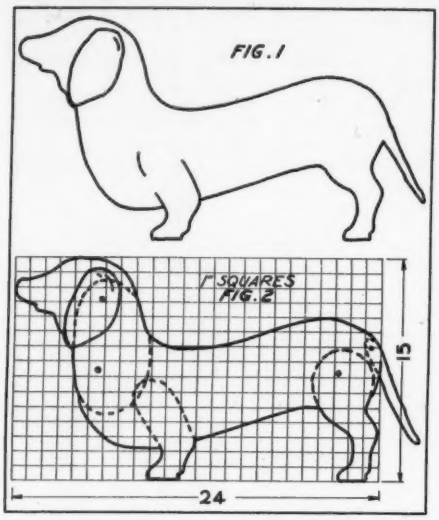
Helen M. Douglas, Commerce, Texas

Suppose that we choose to make a marionette an intelligent, sympathetic, clever dog, such as the dachshund. This type of dog may be made short haired, long haired, or rough haired. The short-haired coat is the most popular. The coat may be of solid color, two colors, or dappled and striped. The black-and-tan is probably the commonest and most favored type. Since our dog is to be trained for exhibition purposes, suppose we dress him for the occasion in a tuxedo. Draw the clothes on him so that they may be painted later. These clothes, when painted on, are more successful than those made of cloth. See Figure 15.

In planning the construction of this dog, jot down on paper the tricks that you will want him to perform. This helps to decide how many joints to make and how to connect the strings to the animal and to the

control. An ordinary animal, one that jumps around mostly, needs only five joints — one for each leg where it is attached to the body and one for the tail. Our dog is to do more than this, so it will be necessary for him to have, besides these five joints, a joint where the neck joins the body, and one at the base of the skull, so that the dog may also raise and lower its head.

Next study the dachshund's proportions. You will find that this breed of dog has a long, low-set body, strong short legs, and is well muscled throughout. His short forelegs are slightly crooked. Measured at the shoulders, this dog's height is 7 to 9 in. The length, from the tip of the nose to the end of his body, ranges from 13½ to 24 in. See Figure 1.



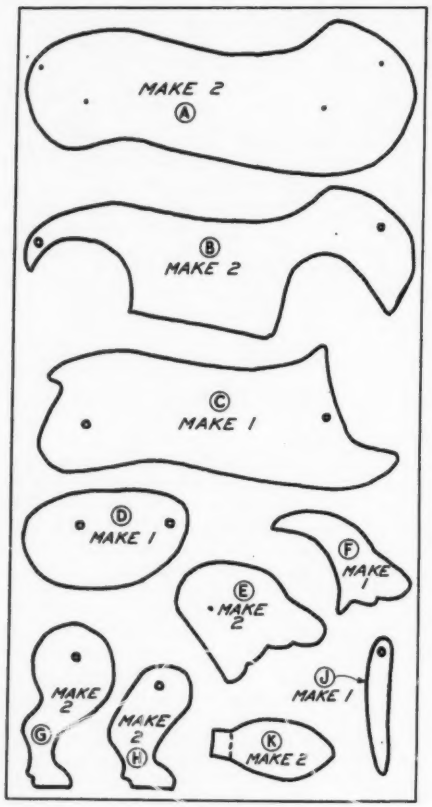


Fig. 3

Since the dachshund's height and length is not so great, you may choose to make it life size. If it is to be used on a stage with marionette figures, or other animals, its proportions should be in keeping with those of the figure and animal used. For solo appearances, it may be made one half the size of the smaller dachshunds. If made thus, your dog would be only 3½ in. high and 6¾ in. long. With these proportions in mind, draw a profile, or silhouette, of it. Notice his round, chunky body and neck and begin locating the essential joints as shown in Figure 2.

The legs and head must be made separately so that each member of the body may be made to move. The neck has two joints, one at the base of the head, the other at the shoulders. If possible, watch the movements of a dachshund, or study pictures of this dog in many poses, so that you may learn to make the wooden replica act more realistic.

The things needed to make a dachshund marionette are: A working drawing, pencil, ruler, a sharp knife, BB shot, some coarse and fine sandpaper, coping or jig saw, four No. 216 bright wire screw eyes, a shingle nail, some No. 18 by 1-in. wire brads, four 2-oz. carpet tacks, hammer, small table vise, cloth or soft leather for the ears, 1 ft. telephone or baling wire, a pair of pliers, strong black button thread, white pine for the control (1 pc. ¼ by ¼ by 9 in., 1 pc. ¼ by ¾ by 7 in., 1 pc. ¼ by 1 by 7 in.), grainless white pine (¼ in. for the body and legs, and ⅛ in. for the two outside body pieces), artist's oil paints or showcard colors (red, black, and white), and a small artist's paint brush.

After the pattern has been made, use it to develop the various profiles shown in Figure 3. Transfer these to the wood as follows: Part A is drawn on the ⅛-in. pine, the other parts are drawn on the ¼-in. pine. As each pattern is drawn onto the wood, mark the places for the holes through the tail, the body pieces, the legs, the neck, and head pieces.

Drill the holes in each piece, or make them with a shingle nail and a hammer before the piece is cut out to prevent splitting. Then cut out the fourteen parts with a jig saw, or coping saw. When this is done, take the two parts marked A; place them together in the vise; and round the edges with sandpaper. The inside surfaces should be left flat. Round parts E, Figure 3, also the lower part of each leg.

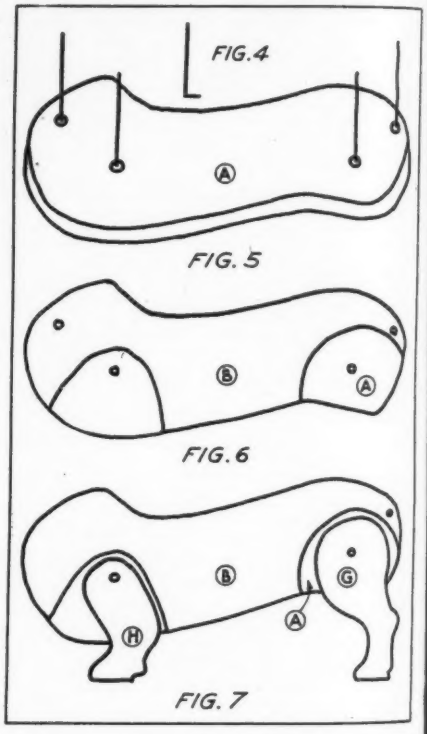
After the four outside surfaces have been prepared, begin the assembling of the dachshund. Cut off 4½ in. lengths of the galvanized telephone wire, turn up ¼ in. on one end of each of the four pieces of wire, as shown in Figure 4. Feed one of these wires with the turned-up end on the outside through the hole in the upper part of the shoulder, put another wire through the hole for the forelegs, then a wire through the body for the hind legs, and the fourth wire goes through the body for the tail. See Figure 5.

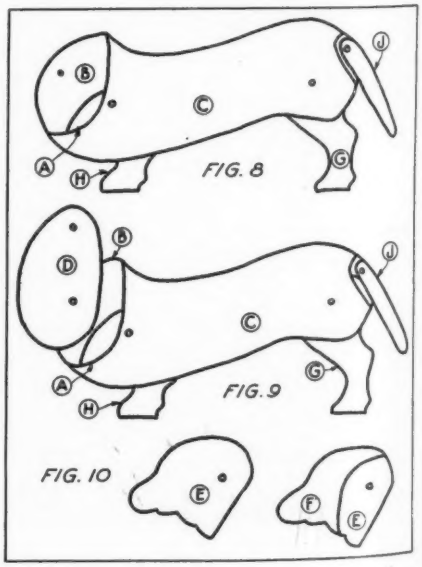
Next, slip one of the B parts into place as in Figure 6, put the foreleg on its wire, place the hind leg on its wire, as shown in Figure 7. Then put on the tail, and carefully place the middle section of the body, part C, into position. See Figure 8. Slip the neck onto its wire as shown in Figure 9. Next feed the second B part onto the protruding wires, and put the fore- and hind legs on correctly, and lastly, put on the second A part.

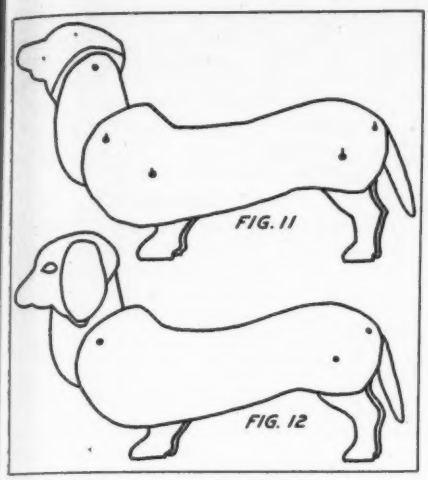
While the animal is lying flat, drive a couple of the one inch, No. 18, wire brads into the sides to hold the five pieces together. With the hammer, slowly turn down the end of each protruding wire, so that they cannot come out of place. Turn the animal over and drive two more brads into the body. Be sure that you do not draw the pieces too tight. There must be enough play for the tail, legs, and neck to move freely.

To assemble the head, place part F over part E and nail into position as shown in Figure 10. Cut off a 1¼ in. piece of wire, turning up ¼ in. on one end. Feed this through the hole in the head; then through the neck. See Figure 11. Lastly, place the other part of the head, part E, into position. Nail it into place, and turn down the end of the protruding wire. The head should be able to move quite freely.

The dachshund has long, velvet-like ears that hang down. Make the ears (See K, Fig. 3) of velvet the color of the dog's hair, or of





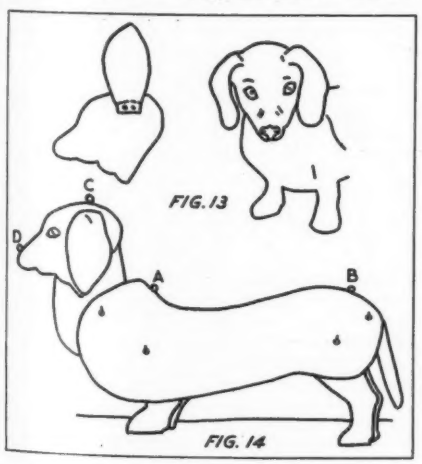


very pliable leather of the correct color. Attach the ears in their proper places on the dachshund's head with No. 2 oz. tacks, as shown in Figure 13. The eyes may be buttons, or half beads, glued onto the head and painted. Be sure that the ears and eyes are put on correctly. If the ears are to be controlled by strings, sew a few small pieces of lead shot in the tip ends of the ears. This weight will make the ear fall back into place when the string is released.

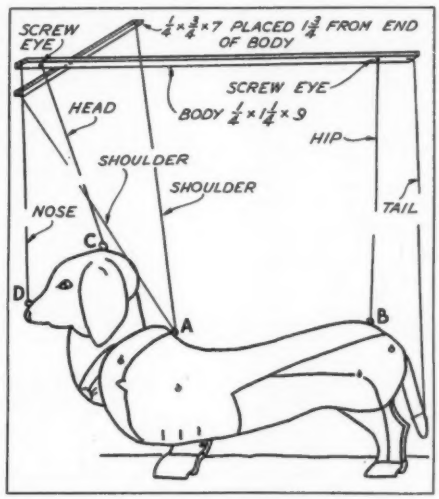
Next screw a No. 216 bright wire screw eye in the animal's spine near the neck joint at A, Figure 14. The second screw eye is placed in the opposite end of the spine at B, the third one is put into the head, at C in Figure 14, and the fourth screw eye is screwed into the lower part of the dachshund's nose, at D.

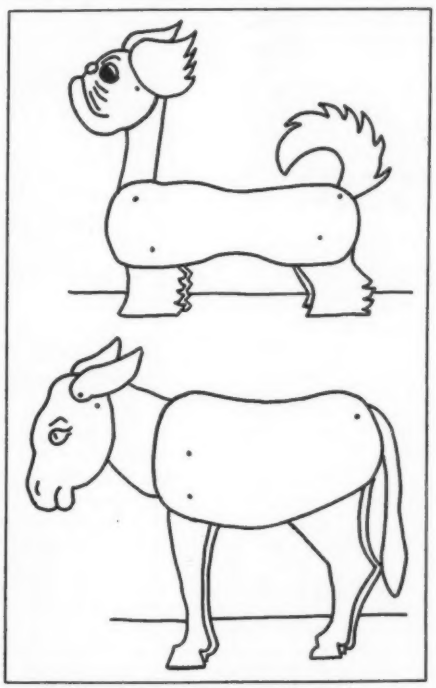
To paint the animal, use artist's oil paints, or show-card colors. The oil paints are more durable but they take much longer to dry. The screw eyes are painted the color of the head and suit so that they will not show. Paint the head, tail, and four feet a reddish brown. The shirt, collar, and tie should be painted snow white, the vest a light cream color, and the coat and trousers, black with a silken black stripe down the legs of the trousers. While the paint is drying, make the control.

The control is made up of three parts—the body, head bar, and ear control. These parts should be made of white pine that is ¼ in. thick. The body of the control is 1¼ in. wide and 9 in. long. The head bar is ¾ in. wide and 7 in. long, and the ear control is 1 in. wide and 7 in. long. Make a hole in both ends of each one of the three parts of the control with a small nail, so that the strings may be attached securely to the control. To assemble the control, study Figure 15 carefully.



To string the marionette, cut off two 30 in. lengths of strong black button thread. Take one of the threads and tie it securely to screw eye A, Figure 14; then extend this thread to the right side of the head bar of the control, run the thread through the hole, and make it fast, as shown in Figure 15. Attach the second thread to screw eye A and fasten it in the hole in the left end of the head bar, making sure that the control is level. Next, tie a longer length of thread to screw eye B, Figure 15; hold the control in a level position; slip the thread through the hole in the rear end of the control body; and make it fast when you have the dog standing on its four feet and the control is level. The third thread is fastened securely to the screw eye on the dachshund's head, C in Figure 15; then on up through the hole in the front end of the body of the control where the string is made taut enough to hold the animal's head erectly. The fourth thread is attached to the screw eye on the front end of the body of the control where it is made secure. This string is used to make the dog raise his nose into the air when he barks. If necessary, a string may be tied to the tail, and the other end of this thread is fastened to the end of the body of the control. Cut off two more long lengths of the thread. Sew one string to the lower end of the right ear, and the other to the end of the left ear. Place the ear control on its peg; then extend the right ear's thread through the hole in the right end of this control and tie, letting the ear hang down. The string on the left ear is fastened to the left end of this control in the same manner. To wiggle the ears, take the ear control in the right hand and move it in see-saw fashion while the main control is held in the left hand.





Additional types that may be used

Give the dachshund life by grasping the control in one hand and rocking it as you move the dog forward. A little practice will make your dachshund an accomplished and admired performer.

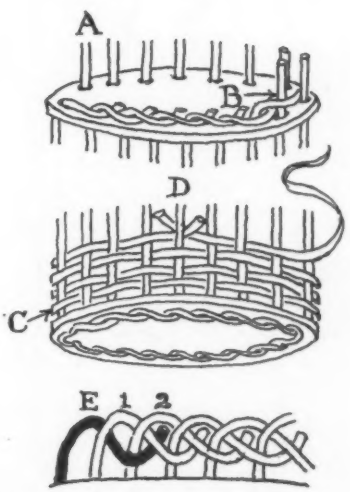
CUFF-BUTTON OR JEWELRY TRAY

Osma Couch Gallinger, Director
Cromaine Crafts, Hartland, Michigan

Materials. One round wood basketry base, 3 in. in diameter, or an oval base measuring 4 by 3 in. The holes in the base should be bored ¾ in. apart, and ¼ in. from the edge. There should be an uneven number of holes. Use No. 4 reed for spokes, and No. 3 for weavers.

Equipment. One pair sharp scissors or basket-reed clippers. One dishpan filled with water. Piece of No. 2/0 sandpaper.

Procedure. 1. Count number of holes bored around edge of base. Cut a like number of



reeds 6 in. long for spokes. Soak them in water. While they are soaking, roll the No. 3 weaving reed into coils, and put these also to soak. Remove spokes, wipe dry with towel,

and insert one spoke through every hole of base, as at A, leaving 1½ in. of spokes below holes. Now bend each of these spoke ends under the base, over spoke at its right, and in back of next spoke, as at B. For last one, lift up first spoke bent over and make room for last one to pass under it.

2. Begin weaving around the spokes with the No. 3 weavers, now pliable from soaking. Start one weaver behind a spoke, as at C, and pass it under and over the spokes in succession. This is called *simple weaving*. Keep encircling the basket with this same stitch. The second time around, pass the weavers over the spokes that they went under before, and vice versa. This is because there is an uneven number of spokes. Bend spokes out slightly as shown in finished basket. Weave sides ¾ in. high.

3. *Piecing.* When a reed gives out, a new piece must be added. To do this, finish with the first end behind a spoke, and start the new end behind the same spoke, as at D.

4. *Border.* When the sides have been woven ¾ to 1 in. high, it is time to begin weaving the border. Finish the end of the weaver behind a spoke and trim off. Be sure that there are the same number of rows on all sides of basket, in other words, that the weaver has been completely around the basket the last time. Before weaving the border, soak spokes well, dipping them down into water, but not allowing the wood tray to become wet. Now take each spoke, as E, bring it under the spoke at its right, as 1, and over the next spoke at its right, 2. Do this with each spoke in succession all around the basket. Insert last end through loop of the first spoke. Tighten up all spokes of the border and let the tray dry. Then shellac with white shellac for light natural, or orange shellac for a more golden color. If preferred, the basket may be stained before shellacking.

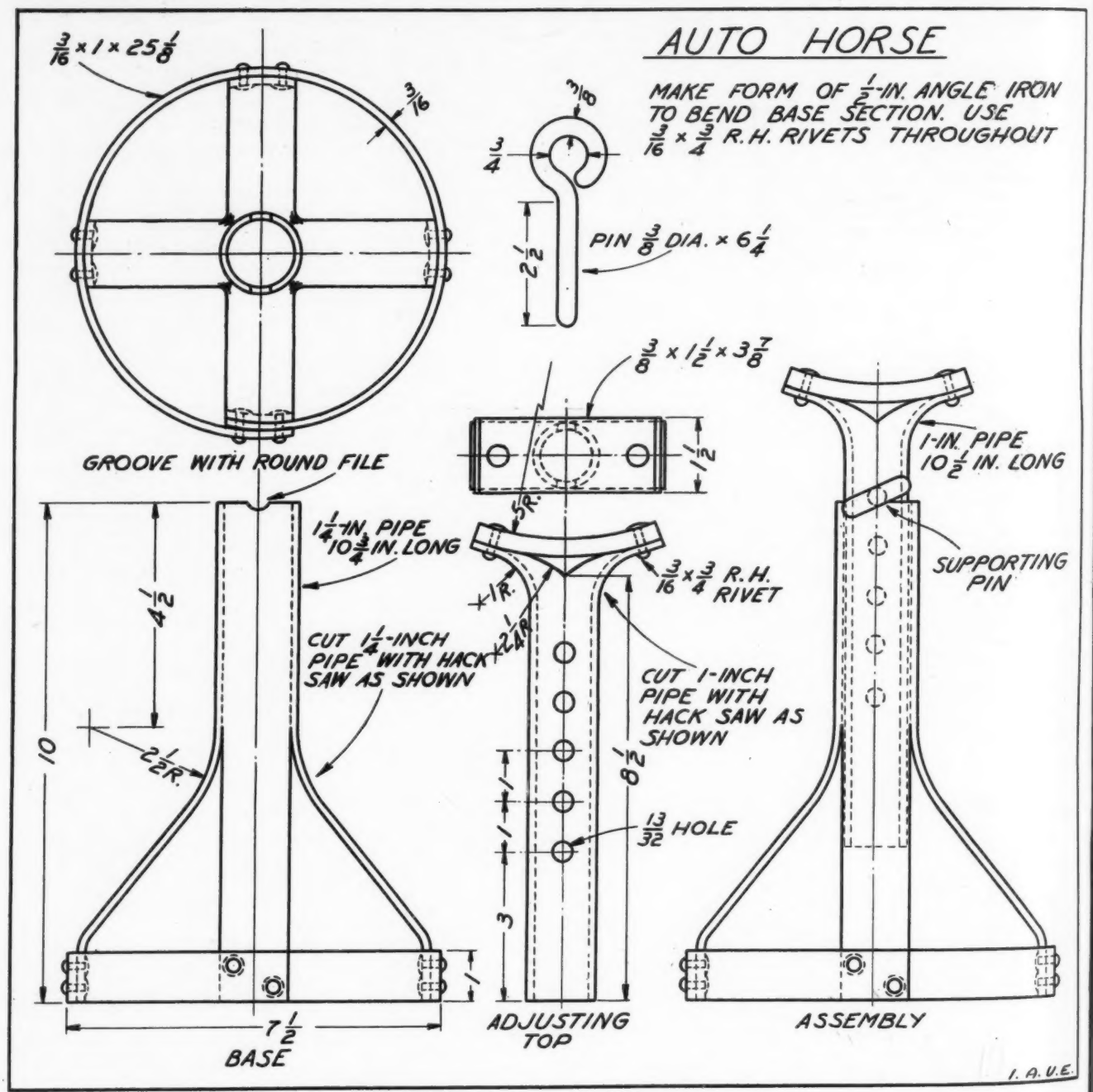
SCROLL CANDLESTICK

Leon H. Baxter, Association for Crippled and Disabled, Cleveland, Ohio

Scroll Candlestick

It is well to first make the scroll handle of this candlestick which is of 16-gauge copper, ¾ by 19 in. Planish this piece on all sides and edges, and as this hammering will harden the metal, it must be thoroughly annealed before bending.

It is well to make a full-sized outline of the curves of this piece on paper to the general dimensions shown in the profile view.



An auto horse by Isaac R. Taylor, Metal Shop, High School, Kearney, New Jersey

Bend over some cylindrical forms, such as pieces of various sizes of iron pipe. See that the curves are flowing and of a graceful contour.

Make base *D* from a piece of 18-gauge copper. Scribe a disk of 3½-in. diameter and planish the upper surface. Dome this ½ in., as shown, either by hammering over a stake, or by forming it on a sandbag or on a lead block. Drill a ⅛-in. hole directly in the center at which it will be riveted to the scroll *C* later.

Next, form pan *B* by either of the two methods suggested previously, seeing that both surfaces and edges are evenly planished. The edge is planished by holding the pan in one hand and pounding lightly with the planishing hammer without holding it against any object. Drill a ⅛-in. hole in the center of this pan also.

Make holder *A* by either method described in the making of the Early Colonial Candlestick. This piece is 2½ in. high. Drip pan *E* is a 1½-in. disk cut from 18-gauge copper with a 13/16-in. hole cut from the center. To cut this hole, use a small drill, insert the saw blade through the hole, and saw the circle out accurately. Planish on surfaces and edges.

Set scroll *C* on base *D* in the position shown in the drawing and locate the hole for rivets to correspond with those in both *B* and *D*, taking care that the handle retains an upright position. Rivet these three pieces together.

Place holder *A* directly over the center of drip pan *E*. Apply flux and small pieces of solder and apply heat. (See "Soldering.") Finally, place these pieces at the center point of pan *B* with flux and solder on the inner, lower edge of *A* and solder in place.

The candlestick is then ready to be cleaned and brightened with fine steel wool and finished as described under ***Finishing*** on page 306 of the September, 1938, issue of this magazine.

APPARATUS FOR DEMONSTRATING LINE-DROP AND POWER-LOSS PROBLEMS

G. Lewis Parsons, Southside High School, Elmira, New York

Every electric-shop instructor is confronted with some difficulty in demonstrating the principles involved in line-drop and power-loss problems. Herewith is illustrated and described a simple, inexpensive apparatus for this purpose, constructed from old parts that may be found around the shop.

Assuming your shop equipment includes an a.c. or d.c. voltmeter and ammeter, the only other requirements are as follows: 1 Soft pine board about ⅞ by 4 by 24 in., suitable screws and bolts, old porcelain wiring cleats; 1 element from old electric toaster; 1 or more cleat sockets, suitable terminals or contacts; 1 or more electric-light bulbs.

The completed apparatus properly connected ready for use is illustrated in Figure 1. Here the ammeter registers the amount of current flowing, and the voltmeter, with flexible leads, is used to indicate the voltage at any point desired. On the extreme ends of the voltmeter leads, a short piece of solid wire may be soldered and bent in the form of a small hook. However, insulated test prods or alligator clips may be used more satisfactorily to make contact with the line.

The electric-toaster element is cut in half and the halves are stretched across the porcelain cleats from *a* to *k* and *b* to *l* as shown in Figure 1. These are used in lieu of long transmission or distribution lines and have sufficient resistance to cause quite a drop in voltage and loss of power between *input* and *load*. This illustrates to a nicety the actual conditions, without the use of long lines or hidden coils, and will carry 5 or 6 amperes without likelihood of burning out. In fact, if a complete element is used, it will not burn out even when short circuited at the load end, but will merely get very hot, as it does in a toaster. Care must be exercised, however, not to short circuit the element at any other point.

With one or more large bulbs placed in the load sockets, and the ammeter properly connected in series, we now proceed to find the voltage drop in each successive section, after recording the load current indicated by the ammeter.

As a means of promoting accuracy and a clear understanding of the results obtained, it is well to record all data in columns as indicated by the sample readings shown in Figure 2.

By placing the voltmeter terminals successively across *a* and *b*, *c* and *d*, etc., the voltage across the line at each of these respective points, can be read directly. Referring to column 5, the voltage across *a b* is 115, but across *c d* it is only 113 volts. This indicates a line drop of 2 volts (see column 6) between points *a b* and *c d*.

The current of 3 amperes is recorded in column 3.

The power actually lost in this section may be determined by multiplying the current (3 amperes) by the voltage drop (2 volts), which gives 6 watts (column 7).

Now glance at the sample results recorded further down in the same data columns, reading Nos. 7 and 8. Here it is found when the current is increased to 6 amperes by increasing the load, the voltage drop between the same points *a b* to *c d* increases in proportion to the increase in current. Column 7 also indicates that the ***power loss*** in this section is now increased to four times as much as when the current was only 3 amperes. This, then, is tangible proof that the power loss is proportional to the *square* of the current.

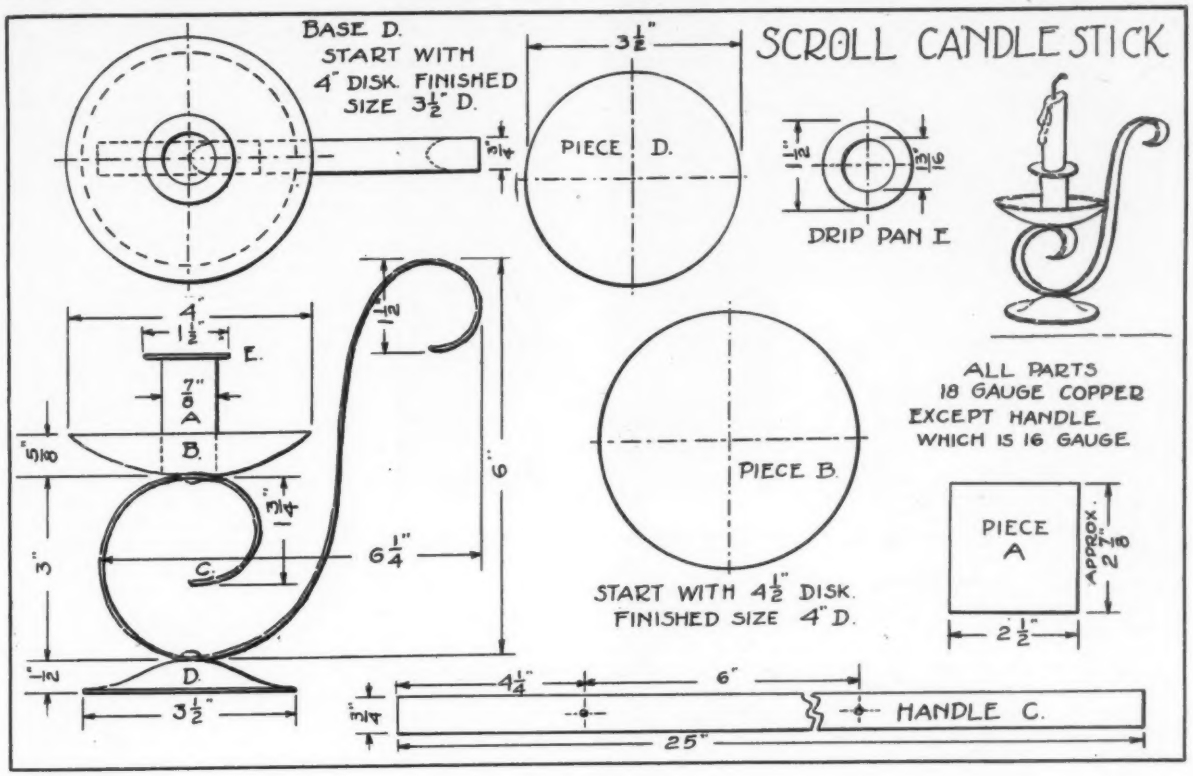


Plate 7

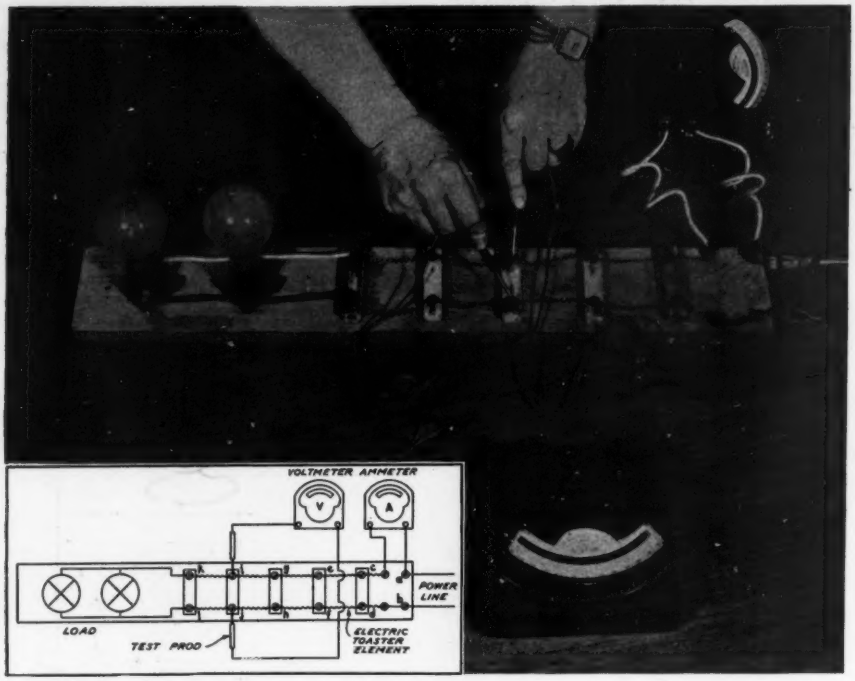


Fig. 1. Apparatus for measuring resistance, line drop, and power losses

All results may be easily checked. For example, by asking the pupil to read the voltage drop longitudinally from *a* to *c* and *b* to *d*, it will be found to be 1 volt for *each* short wire in this section, or 2 volts for both. This checks with the results already obtained for the same section and recorded in reading No. 2 under column 6. Then again, 1 volt drop × 3 amperes, equals 3 watts loss in wire *b d*. A loss of 3 watts in each wire giving a total loss of 6 watts, checks exactly with the results already secured for the same section in reading No. 2 column 7.

Many problems and methods of checking and cross checking results will suggest themselves to the teacher using this simple device. One interesting problem is to compute the actual length of a line giving results equivalent to these obtained by this small model.

COLUMN NUMBER							
1	2	3	4	5	6	7	
Load Used	Reading Number	Load Current Amperes	Voltmeter Connected Across Line	Voltage Volts	Line Drop Volts	Power Loss Watts	Remarks
2-150 watt bulbs	1	3	ab	115			Section I of resistor
	2	3	cd	113	2	6	
	3	3	ef	110	3	9	
	4	3	gh	107	3	9	
	5	3	ij	104	3	9	
	6	3	kl	101	3	9	
		3	ab to kl		14	42	Total for entire unit
2-300 watt bulbs	7	6	ab	115			Load doubled (Compare with readings 1 & 2)
	8	6	cd	111	4	24	
2-150 watt bulbs	9	3	ac		1	3	Check for Section 1, Readings 1 & 2
	10	3	bd		1	3	
		3	ac & bd		2	6	Checks with reading 2

Fig. 2. Sample data sheet. — For sake of clearer illustration, the above data is shown in round numbers. The readings will actually vary somewhat due to slight differences in the length of the resistance wires comprising the various sections, etc., of the element, and also due to the human factor

For instance, in order to find the length of a No. 14 B & S gauge copper line (2 wires) with results equivalent to those obtained between points *a b* and *c d* using a load of 3 amperes, and a total line drop of 2 volts; we may simply apply this data to the formula:

$$l = \frac{Vd \times C.M.}{K \times I}$$

Here Vd = 2 volts drop in this section of line; C.M. = 4,107 the circular mil area of No. 14 wire; K = mil-foot resistance of copper at average temperature (use 11 ohms); I = current in amperes; l = length of line (2 wires) in feet.

Substituting this data in the formula:

$$l = \frac{2 \times 4{,}107}{11 \times 3} = \frac{8214}{33} =$$

149 ft. length of an equivalent 2 wire line using No. 14 copper wire.

Using Ohm's law, the resistance at any point may be obtained by dividing the volts at that point by the current in amperes.

For example, the resistance of the circuit at *a b* is 115 ÷ 3 equals 38.3 ohms, and at point *k l* is 101 ÷ 3 equals 33.7 ohms. Therefore, we find the total resistance of the unit to be, resistance at input — resistance at output, or 38.3 ohms — 33.7 ohms equals 4.6 ohms.

The effect of an increase in temperature on resistance can be demonstrated by first measuring the resistance of the wires with only a 25-watt bulb for a load, then by comparing this result with one obtained by measuring the resistance again while using a 150-watt load. An increase in temperature will materially increase the resistance.

Summarizing, we find this simple apparatus enables us to clearly illustrate, solve, and check problems, relating to Ohm's law, power loss, and line drop.

FOLDING METAL BOOK ENDS

L. C. Peterson, Director, Department of Industrial Arts, Southern Illinois State Normal University, Carbondale, Illinois

This type of book end is not only useful and strong but also very convenient. Of low cost, it may be made quite beautiful. Furthermore, it may readily be made by amateurs, high-school students, and others who enjoy improving their artistic talent in their spare time.

Material. A pair of book ends will require 1 ft. square of No. 24 sheet brass, copper, or aluminum, and four ⅛ by ¼-in. rivets.

Problem. To learn how to make a pair of book ends and to apply a decorative design, selected and adapted to embellish a given space, by etching, embossing, or engraving.

Procedure. 1. On strong heavy paper, make full-size drawings of both base and upright pieces. Cut to exact sizes, fold up the margins, assemble the parts, and insert pins to locate exact points for pivots to secure perfect swing of the upright piece.

2. Transfer the pattern to the metal. With a sharp awl, draw lines to show the exact location of all cutting, bending, and drilling. Cut out the metal to the required shape and size.

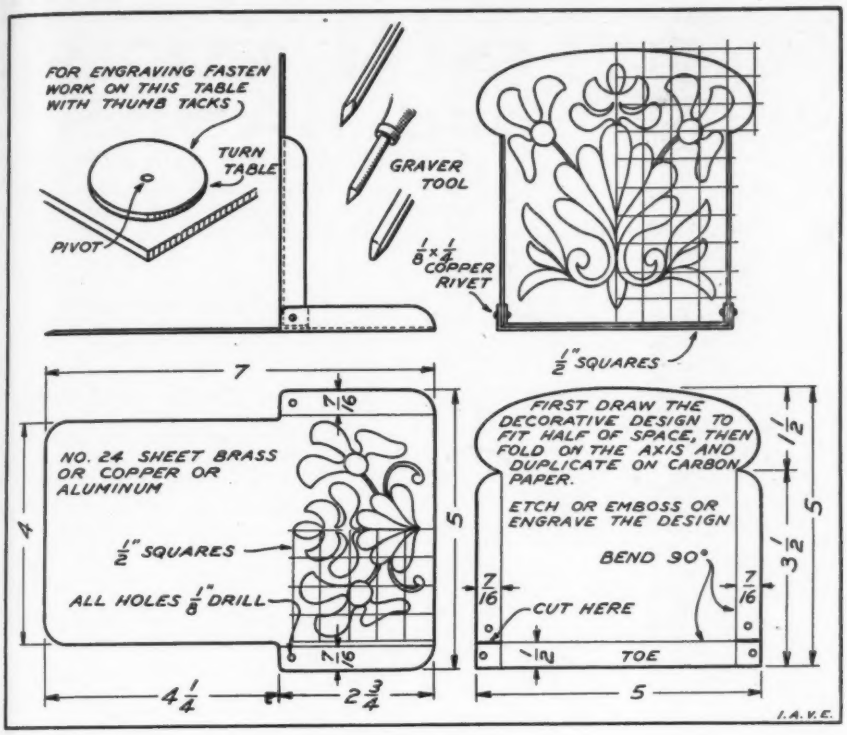
3. Work out a decorative design to fit the upright piece. Develop this on one side of the vertical axis, then fold the paper on the axis, and with carbon paper, duplicate the design on the second half. Place carbon paper on the metal and place the design over this in the correct place. Then trace over design with a hard pencil, a stylus, or a knitting needle. Remove the paper, and reinforce the lines with a soft pencil.

4. If the design is to be etched, apply a thin even coat of paraffin wax over the metal by warming the metal enough to melt paraffin shavings sprinkled over it. After the paraffin has cooled, scratch the design through the coating down to the metal and then apply strong nitric acid with a thin stick. Renew the acid application until the lines are etched about 1/64 in. deep.

5. For embossing, the design is scratched on the back side of the metal. This is then placed on a soft piece of wood, and the pattern is sunk into the wood as the metal is forced down by hammering on a ball-pointed tool, such as can be made from spikes or nails by filing the point hemispherical. Force the metal down so as to produce, on the underside of the metal, smooth, bold, rounded, and well-defined figures and beautiful shapes.

6. For engraving, first draw the design in black pencil lines on the metal. Fasten the metal, with thumb tacks, onto a circular board, fixed to rotate on a central pin so as to swing the metal when cutting curved lines. The engraving is done with a tool such as can be made from a piece of a three-cornered file, whetted to a keen edge. (See sketch of graver tools.) Take well-guided, smooth cuts. Avoid slipping.

7. Next, make all 90-deg. bends, first the sides on the upright piece, then the lower edge, then on the base piece. Drill holes for the rivets in margin bent up on the base piece. Then assemble the uprights with the base piece, and mark and drill the upright piece. Next, reassemble the parts, insert the rivets from the inside, support the head of the rivet on a concave rivet set and shape a rounded head on the protruding end. File all edges smooth. Polish all over, and apply a coat of clear lacquer.



Folding book ends

all the outlines of the design. Use the dapping tool to give surface of the metal a hammered effect.

All this work has been done before the exact outline of the key plate has been cut. The next step is to cut this outline, and to put in the keyhole with a chisel. Clamp the metal on a smooth piece of steel and cut the outline. File all edges as shown. Drill holes for the nails.

KEY PLATE

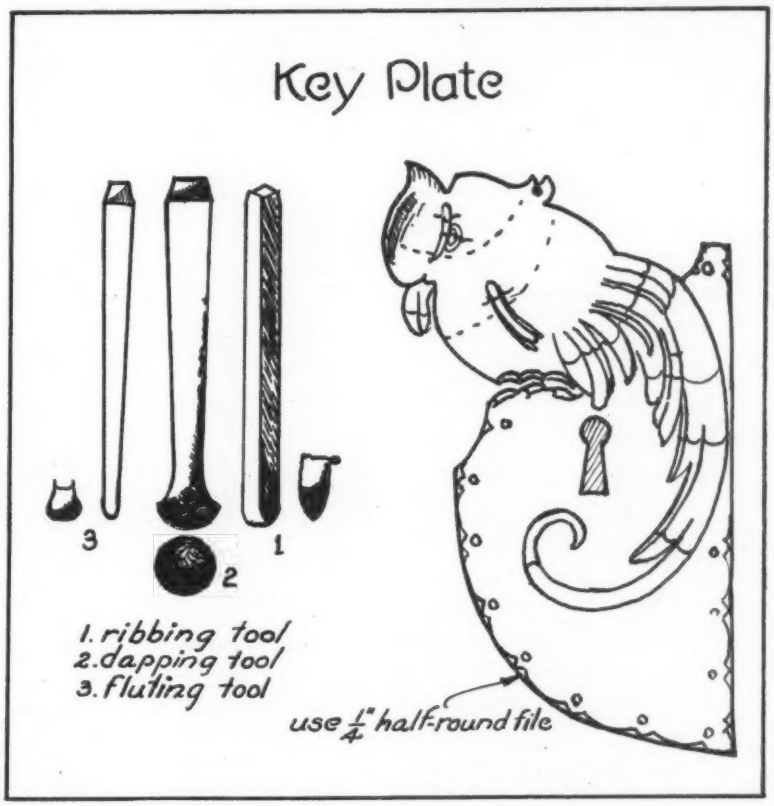
Edmund Schulte, Metal Sculptor and Repousseur, Greenwich, Connecticut

The key plate, shown herewith, merely requires the use of simple tools, properly used. These tools must be made before the job is started. To try to make an article without the proper tools is inviting trouble and the possibility of spoiling the metal.

Select a piece of soft metal 3½ by 5 in. This may be 20-gauge B. & S. copper, brass, monel, pewter, or architectural bronze. Trace the design on tracing paper and paste the tracing on the metal with plasticine or scotch tape. Leave metal around the design. This metal will be removed after the work is done. After the tracing has been fastened to the metal, slip a piece of carbon paper under it, and with a steel stylus or round-end instrument, trace the design onto the metal. Then remove the tracing paper from the metal. Fasten the metal onto a pitchpad by bending over each corner of the metal and sticking them into the pitch. Weight the metal so that no air bubbles are under it. Allow the pitch to cool, or hold under running water. Be sure to wet the metal before it is placed on the warm pitch. This will enable one to easily remove the metal for annealing.

Use the ribbing tool and go over all lines of the design. Do not force the tool too much. The metal must not be cut. After all of the lines have been seated, warm the metal slightly, remove it from the pitch, and anneal it. Dip into water to cool. The metal may be cleaned at this point, but it is not necessary.

Soften the pitch to make it smooth for the next operation. Remember that pitch *must not be burned*. Dip the metal into water, place on pitch with the reverse side of the metal up. The shape of the bird is now formed with the bowl-shaped tool. Go over the body of the bird, making it rounded as shown in the drawing. Remove the metal, anneal, and replace in the same spot on the pitch. Use the fluting tool for shaping the beak, tail scroll, and the feathers.



Remove the metal, anneal, warm the pitch to make the surface smooth. Now fill the back of the bird with pitch so that the raised part will have some backing. Attach to pitch with hand pressure. Use the ribbing tool to sharpen

Dip into a bath of 2 parts water and 1 part potash. Let it remain in this solution until it is perfectly clean. Wash in cold water, then in hot water, and dry in hardwood sawdust. This method does not make the metal full of water marks. The finishing of the plate may be done with liver of sulphur and any

of the other methods for finishing the job. It is best to give the metal a thin coat of water-clear lacquer before it is placed in use.

FALSE FACES AND MASKS

W. Ben Hunt, Hales Corners, Wisconsin

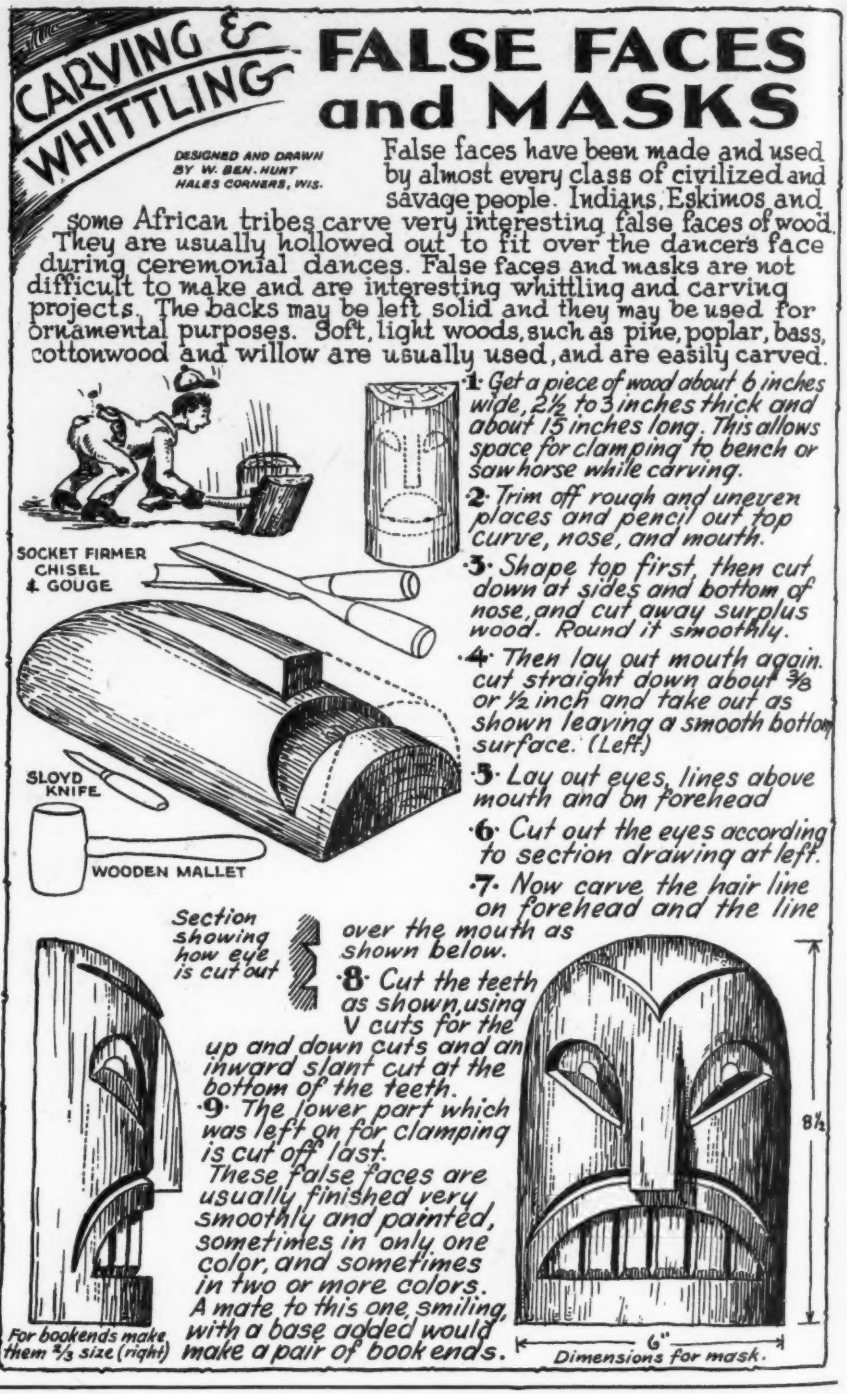
The plates shown herewith depict false faces that are made in imitation of the heavy wood masks which were made and used by the members of the false-face societies common among the Iroquois Indian tribes.

The Iroquois were a federation of the Seneca, Oneida, Onondaga, Mohawk, and Cayuga tribes. Of these the Senecas were probably the first to inaugurate societies of this kind, but all of the other four tribes also were acquainted with them, and the rites are still carried on among the eastern Iroquois.

The members of these societies wore these masks representative of various mythological personages, while trying to cure the sick, alleviate pain, exorcise witches, and drive out demons.

The false-face society was a secret organization. Membership could be achieved by dreaming about the masks, or about the society's ceremonials. Information, about the dream, had then to be given to the proper person, a feast at which the initiation took place had to be given, and membership was established. The matter of leaving the society was just as simple. Dream about being a member no longer, report this, and give a farewell feast.

The false faces shown may be altered to suit varying tastes. They will make excellent wall decorations for clubrooms, camp lodges, and scout troop quarters.


CARVING & WHITTLING
FALSE FACES and MASKS
DESIGNED AND DRAWN BY W. BEN. HUNT HALES CORNERS, WIS.
False faces have been made and used by almost every class of civilized and savage people. Indians, Eskimos and some African tribes carve very interesting false faces of wood. They are usually hollowed out to fit over the dancer's face during ceremonial dances. False faces and masks are not difficult to make and are interesting whittling and carving projects. The backs may be left solid and they may be used for ornamental purposes. Soft, light woods, such as pine, poplar, bass, cottonwood and willow are usually used, and are easily carved.
SOCKET FIRMER CHISEL & GOUGE
SLOYD KNIFE
WOODEN MALLET
1. Get a piece of wood about 6 inches wide, 2½ to 3 inches thick and about 15 inches long. This allows space for clamping to bench or saw horse while carving.
2. Trim off rough and uneven places and pencil out top curve, nose, and mouth.
3. Shape top first, then cut down at sides and bottom of nose, and cut away surplus wood. Round it smoothly.
4. Then lay out mouth again. cut straight down about ⅜ or ½ inch and take out as shown leaving a smooth bottom surface. (Left.)
5. Lay out eyes, lines above mouth and on forehead
6. Cut out the eyes according to section drawing at left.
7. Now carve the hair line on forehead and the line over the mouth as shown below.
Section showing how eye is cut out
8. Cut the teeth as shown, using V cuts for the up and down cuts and an inward slant cut at the bottom of the teeth.
9. The lower part which was left on for clamping is cut off last.
These false faces are usually finished very smoothly and painted, sometimes in only one color, and sometimes in two or more colors. A mate to this one, smiling, with a base added would make a pair of book ends.
For bookends make them ⅔ size (right)
8½
6"
Dimensions for mask.

PRINTING EDUCATION WEEK

The eleventh annual Printing Education Week will be held during the week of January 16, 1939, under the auspices of the National Graphic Arts Education Guild. During the week, an opportunity will be given to pay tribute to the memory of Benjamin Franklin. Information can be secured from Mr. Chester A. Lyle, printing instructor, McKinley High School, Canton, Ohio.

END OR SIDE TABLE

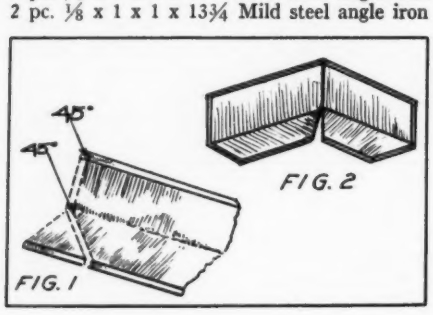
Floyd Keith and J. E. Ray, The Stout Institute, Menomonie, Wisconsin

This project has been used for some time as one of the regular class problems in the general metal courses at the Stout Institute. It has not only stimulated interest but has proved very useful in teaching some of the fundamentals of metalwork, including many types of steel welds. The result of using tile and cement in combination with the steel is very pleasing.

A student with some ability in metal should be able to complete this table in about fifty or sixty hours of work.

Material for the Top

2 pc. ⅛ x 1 x 1 x 23	Mild steel angle iron
2 pc. ⅛ x 1 x 1 x 13¾	Mild steel angle iron



Procedure

Lay out a 45-deg. angle on both ends of each piece of angle iron used for the top as shown in Figure 1.

With a hack saw carefully cut along the outside of these lines. Dress with a file leaving a clearance for expansion when welding as in Figure 2.

Check the sides and the ends for length before welding. Weld a side and an end together, welding on the outside only. Be sure to get good penetration. Build up the outside corner so that it may be dressed, giving a full corner. While hot, check for squareness and make necessary corrections, if any. The underside should be dressed so that it is flush. Weld the other side and end and finish the same as the first corner. The two assembled pieces are then welded toegther and the corners dressed, completing the top frame as in Figure 3.

Material for the Legs

4 pc. ⅜ x ¾ x 10	Mild steel
2 pc. ¾ x ¾ x 7⅛	Mild steel
2 pc. ⅜ x ¾ x 21	Mild steel
2 pc. ¼ x ¾ x 21	Mild steel

Procedure

Lay off 3 in. in the center of the two ¾ by ¾ by 7⅛-in. pieces for the twist. Mark with a center punch so that they may be located when hot. Heat these pieces one at a time in a clean forge fire or gas furnace.

FALSE FACES and MASKS
may be made anywhere from 1 inch high to life size depending upon the material available and the ambition of the craftsman. If used for a wall decoration, bore a slanting ½ inch hole into the back, on the center-line, near the top, and hang as shown
WIRE
WALL
MASK
IROQUOIS FALSE FACE
Both of these masks are painted a reddish brown and most Iroquois false faces have pieces of tin or brass with holes in them for eyes.
WISCONSIN ONEIDA
These small sketches are about the actual size of the original. There was a cord attached and it was probably worn as a badge to show that the warrior was a member of the Iroquois False face Society. These small masks are a lot of fun and can be made with nothing more than a sharp, small-bladed pocket knife.
The mask shown below is very attractive and is not difficult to make. A triangular billet is cut as shown and most of the carving is done on the two flat sides. Careful painting helps a lot in making this one.
TOP VIEW
IROQUOIS FALSE FACE
RED LINE
W
R
B
W-WHITE
R- RED
B- BLUE
THE REST IS BLACK
THUNDERBIRD MASK FROM BRITISH COLUMBIA
The false faces and masks shown on this plate are from sketches made at the Milwaukee Public Museum and are some of the most interesting ones. They are shown here to show what Indians can do with a very few tools, probably with only a knife of some sort. The plate on the opposite page shows the simplest kind of mask carving and the same method can be used in making more elaborate ones.

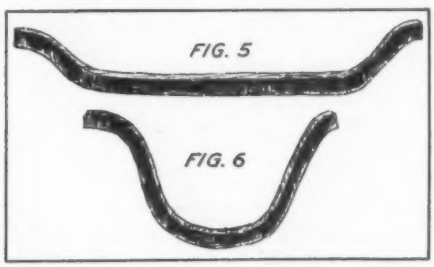
Tile end or side table

When they reach a full yellow heat make one complete twist between the center punch marks using a vise and a monkey wrench. This work must be done quickly to secure an even twist. Check for straightness while hot.

The four pieces ⅜ by ¾ by 10 in. that make the top of the leg may be formed by rolling in a large forming roll or they may be formed hot, using a bending fork as in Figure 4.

The two pieces ⅜ by ¾ by 21 in., when formed, make the feet. These pieces may be formed in a forming roll, with a bending fork, or over the horn of the anvil with a hammer. First form the ends of the pieces as in Figure 5. Then form the center section which completes the curve as in Figure 6. The ends which rest on the floor should be heated, feathered out and rounded on the bottom to prevent cutting or scratching the floor or rug as in Figure 7.

The two pieces ¼ by ¾ by 21 in. form the scrolls for the feet. The ends are heated and feathered out. While hot the scroll should be started over the rounded edge of the anvil using glancing blows with the hammer as in Figures 8 and 9. The forming of the scrolls is completed with the bending fork. Keep the stock at a yellow heat while working. See Figure 4. In forming scrolls it is well to bear in mind that a uniform heat will give a smooth scroll. If unevenly heated the scroll will be irregular. After the scrolls are formed take a full yellow heat between them and start forming over the horn of the anvil. Reheat and finish fitting as in Figure 10.



Assembling the Legs

Grind a 45-deg. chamfer on both sides of both pieces of the feet along the line of contact as in Figure 11. Line up the pieces for welding by placing bars on a level surface underneath the pieces to be welded. This is done to clear the ends of the scrolls which have been feathered out. Use a large tip for preheating. Use a smaller tip for welding. Tack weld at the center. Pull the scrolls into position and tack weld. With a ⅛-in. steel filler rod, weld both sides along the line of contact. Build up the weld so that it may be ground and buffed flush with the surface. Care should be exercised when welding not to melt down the arrises on either piece.

Grind all the other pieces to be assembled as in Figures 12 and 13. A little care in setting up the work for welding will save much time

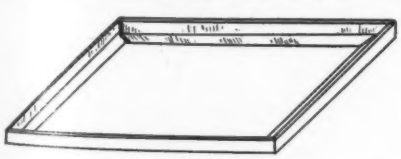


Fig. 3

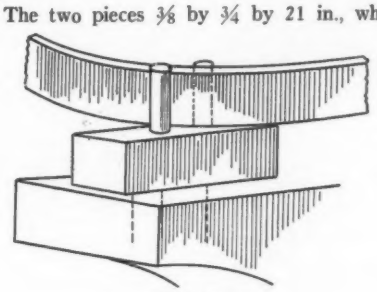
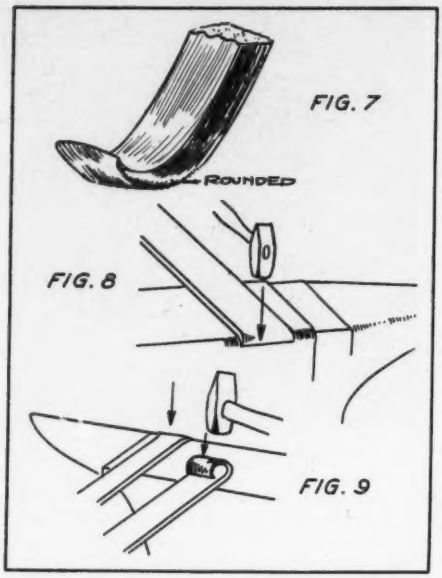


Fig. 4



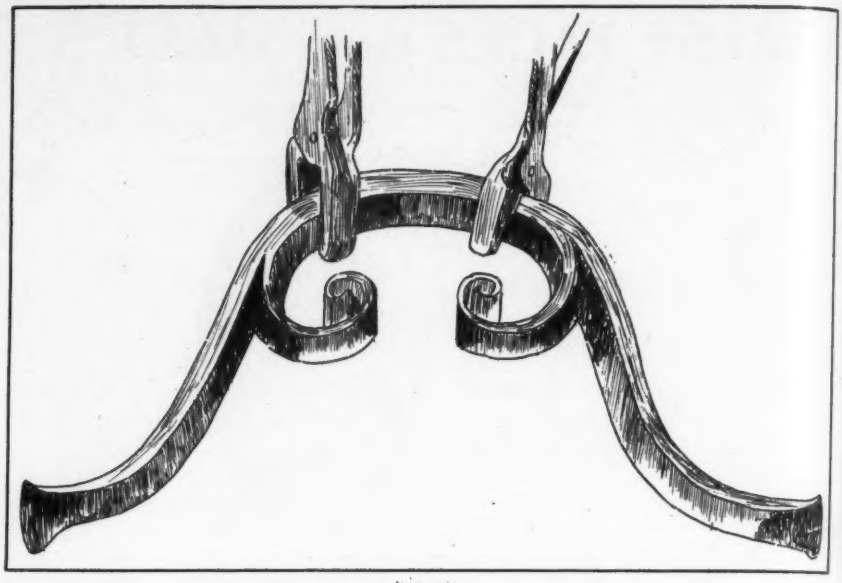
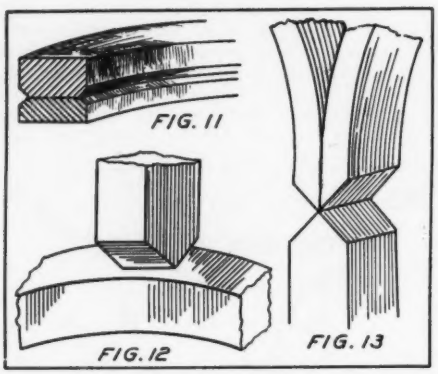


Fig. 10



in straightening afterward. Be sure all pieces are centered and that they are in line before starting to weld. Clamp the two pieces which form the top of the leg to a heavy bar. Line up the piece that is twisted for welding. See Figure 14. Weld from the two sides that are beveled. Be sure to get thorough penetration. Build the weld up enough to give full dimensions and a smooth curve when ground and buffed. After grinding and buffing the above pieces, they are ready to be welded to the feet. Be sure that all parts are completed before assembling, because it is much easier to grind and buff them before they are welded into one piece. Set up the pieces on a flat plate using blocks for lining up. Check the center line and for squareness before making this weld. Weld from the two opposite sides which are beveled. Build up enough so that this weld may also be chipped, ground, and buffed to finished dimensions. When through welding the legs, check for height and squareness.

The top of the legs are prepared for welding to the angle-iron frame by sawing or grinding as in Figure 15. They are then welded to the angle-iron frame. A bead or reinforcing fillet is left on the inside. The two outside corners are ground and buffed flush with the angle iron after they are welded.

Material for the Stretcher

1 pc. ¾ x ⅝ x 21½
2 pc. ¼ x ¾ x 22½

Procedure

The ¾ by ⅝-in. piece is checked for length by measuring the distance between the legs on the inside at the point where they are welded to the angle-iron top. After cutting or grinding to exact length prepare the ends for welding to the feet by grinding as in Figure 16. The two scrolls are formed up hot using the procedure given for the scrolls for the feet. The scrolls and the stretcher are then prepared for welding by grinding a small *V* at the five points of contact on each side. These pieces are then lined up on a flat plate and welded. After welding they should be finished to size. A cold chisel is then used to score the metal along the line of contact to improve the appearance.

Fig. 15

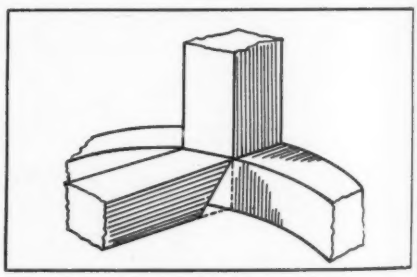


Fig. 16

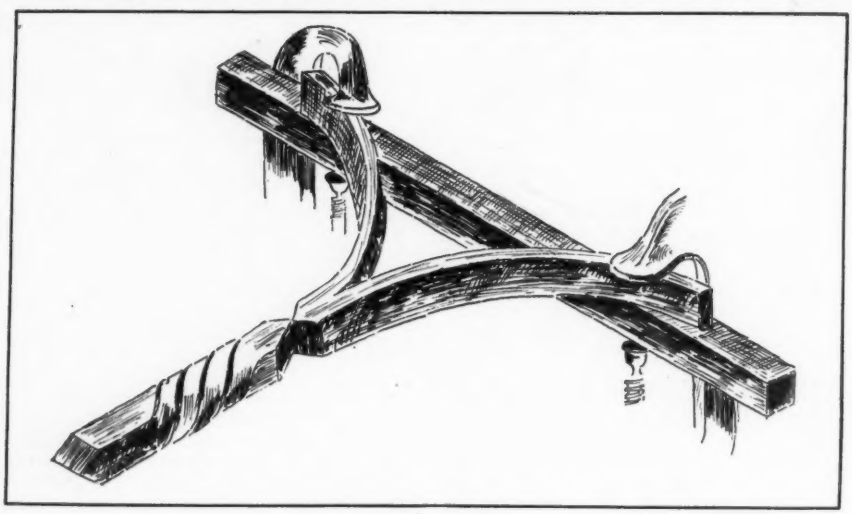


Fig. 14

Material for the Floor of the Top

8 pc. No. 10–24 r.h. machine screws
8 pc. ⅛ x ½ x 2½ Mild steel
1 pc. No. 24-gauge, 13¼ wide Black iron

Procedure

This piece of metal is cut to length after corrugating in a cornice brake. The ¼-in. brakes are made at an angle of about 45 deg. as shown in Figure 17. This piece is then fastened to the inside of the angle iron using the eight pieces ⅛ by ½ by 2½ in. and the machine screws. Drill a body hole through the center of the flat pieces to receive the machine screws. Locate three on each side and one on each end. The holes in the angle iron should be tapped to receive the 10–24 machine

screws. The corrugated floor should be pulled into place without having any spring in it. Cut off the machine screws flush with the bottom.

Finishing

All loose oxide should be removed with emery cloth and all sharp corners slightly rounded. We have been using a dead black finish. This finish is used all over with the exception of the inside of the top. This finish is made by using two coats of black slating paint covered with a coat or two of wax and not rubbed down.

The inside of the top must be carefully sealed in order to avoid rust spots in the white cement. This may be done by using two coats of a good black enamel. We have been covering the enamel with a coat of acid-resisting varnish and find that this will give a positive seal if not broken when setting the tile.

Material for Setting the Tile

15 pc. 3/8 x 4¼ x 4¼ Glazed tile
Keene's cement
White silica sand

Procedure

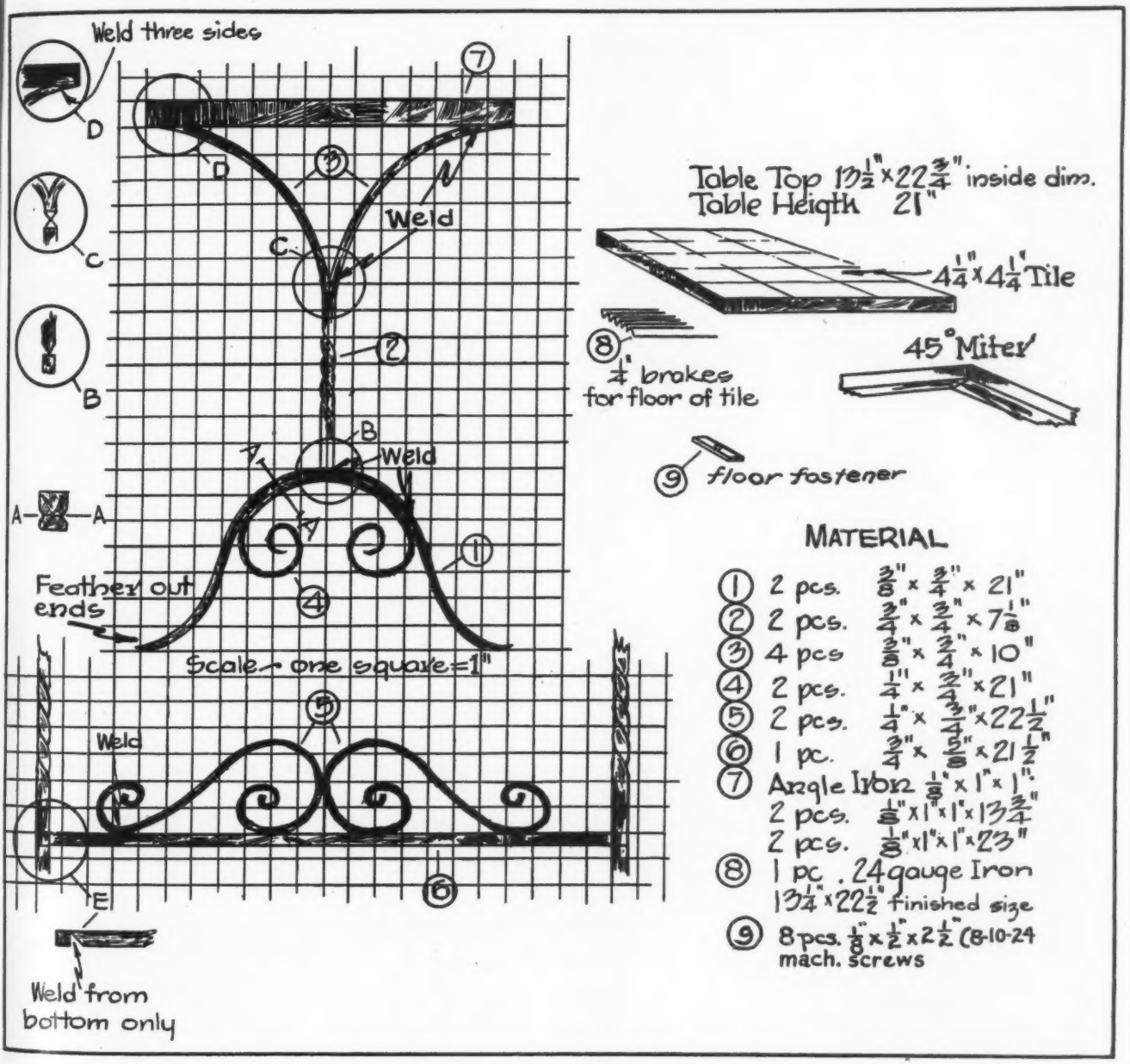
Select the tile for uniformity in thickness, square edges, and freedom from warping.

Soak the tile in water. This is to make a good bond with the bed of cement they are laid upon. Remove the tile from the water and allow the surplus water to dry off. The tile should not be too wet, because, if they are, they will slip out of position when set.

Mix 1 part of white Keene's cement with 2 parts of white dry silica sand. This should be mixed very thoroughly so all sand will be covered with cement.

Add water sparingly while in the process of mixing, until the required amount has been mixed to the consistency of a mortar, stiff enough so that it will not slump in the pile. The concrete bed should be fairly firm so that when placing the tile they will be level and will not settle out of line.

Make two pieces of tin plate to fit over the edges of the angle-iron top to protect the finish while using the screed board. See Figure 17. Provide the screed board shown in Figure 18 with notches on the ends so that it levels off the concrete at 1/16 in. less than the thickness of the tile from the top. The screed board should have about ⅛-in. play inside the metal frame so it will pull easily in leveling off the concrete. The trowel is used to scrape out the surplus, in order to have a level and uniform bed upon which to set the tile. It will be well at this time to try a tile or two and see if the proper height has been obtained. If not, either add more concrete or take some out. This may be done accurately


Weld three sides
D
C
B
A
Weld
Feather out ends
Scale - one square = 1"
Weld from bottom only
Table Top 13½" x 22¾" inside dim.
Table Heigth 21"
4¼" x 4¼" Tile
45° Miter
brakes for floor of tile
floor fastener
MATERIAL
① 2 pcs. ⅜" x ¾" x 21"
② 2 pcs. ¾" x ¾" x 7⅛"
③ 4 pcs ⅜" x ¾" x 10"
④ 2 pcs. ¼" x ¾" x 21"
⑤ 2 pcs. ¼" x ¾" x 22½"
⑥ 1 pc. ¾" x ⅝" x 21½"
⑦ Angle Iron ⅛" x 1" x 1".
2 pcs. ⅛" x 1" x 1" x 13¾"
2 pcs. ⅛" x 1" x 1" x 23"
⑧ 1 pc. 24 gauge Iron
13¼" x 22½" finished size
⑨ 8 pcs. ⅛" x ½" x 2½" (8-10-24 mach. screws

Details of side or end table

by adding or cutting out a piece in each end of the screed board. Sprinkle a couple handfuls of dry cement over the bed of concrete before setting the tile. This will give considerable more suction, and a perfect set for the tile.

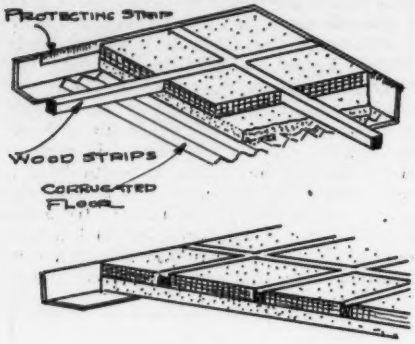
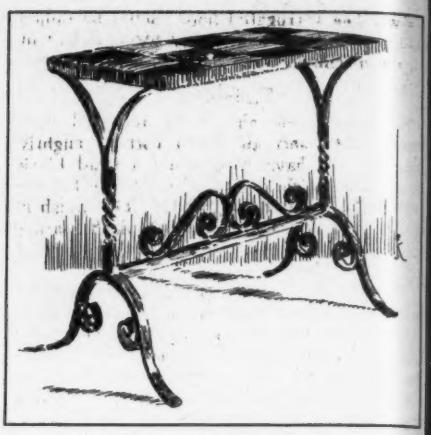


Fig. 17

Place the wood joint strips between the tile. Then place the tile in position starting from one end. Settle them slightly by tapping with the trowel handle to make a good bond. See Figure 17. After all the tile are in place remove the strips carefully. Do not disturb the tile, unless some need adjusting. Do this with a trowel sighting down the joints at the same time. Slight imperfections in alignment may be corrected this way.

Fig. 18

The joints are now filled by pointing them with a trowel, or by pouring the concrete in the joints. The joints should be left a trifle above the top of the tile until they have enough set to cut off with the trowel. The joints are now struck with a trowel, or with a round jointer equal in thickness to the width of the joint, so it will ride on the edges of the tile when running over it. All striking of the joints should be done as carefully as possible, because this really makes the finished job in tile setting. Repoint where necessary. If the joint has become too hard, wet the jointer and restrike. Too much restriking will give a glaze in spots which is not desirable. Always keep a uniform pressure when striking. Cut off the fringe along the edges of the joint, and brush off with a soft brush. Cover with a wet cloth and keep moist for several days.



The finished table

Wipe off surplus concrete such as smears and daubs with a damp cloth. Finally finish with a dry cloth.

After the top has dried for several days give the joints three or four coats of water clear lacquer.

THE MORTISE-AND-TENON JOINT—XI

John E. Doren, High School, Eureka, California

(Continued from page 446, December, 1938)

The Mortise-and-Tenon Joint on Rabbeted Stock

Case II. Stock Rabbeted on One Edge ± 2/3 of Its Thickness

This variety of tenon is used in the construction of panel frames where the panels are designed to be held in deep rabbets by means of moldings called "stops." As in Case I, one cheek of the tenon must be in line with one face of the rabbet. Study Figure 100. *Note:* The width of the rabbet is measured in the same direction as the width of the stock.

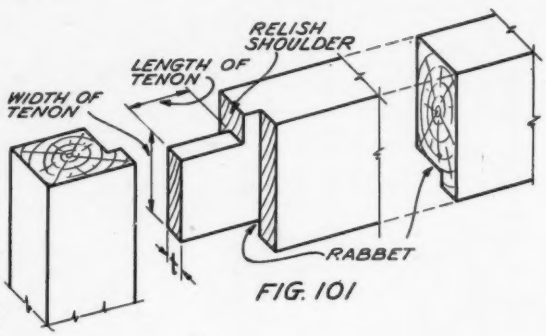


FIG. 101

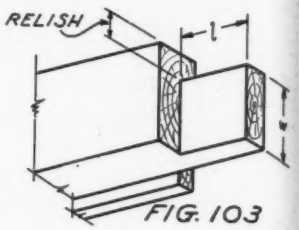


FIG. 103

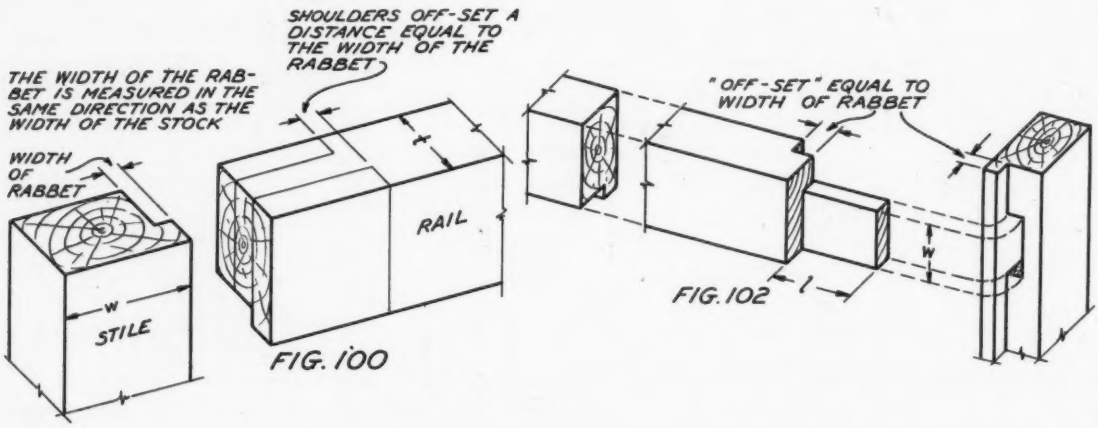

SHOULDERS OFF-SET A DISTANCE EQUAL TO THE WIDTH OF THE RABBET
THE WIDTH OF THE RABBET IS MEASURED IN THE SAME DIRECTION AS THE WIDTH OF THE STOCK
WIDTH OF RABBET
W
STILE
RAIL
"OFF-SET" EQUAL TO WIDTH OF RABBET
W
l

FIG. 100 FIG. 102

Figure 100 shows the layout for a tenon on a rail rabbeted approximately two thirds its thickness. Notice that the shoulders are offset a distance equal to the width of the rabbet on the stile, and also that the width of the tenon is reduced by the rabbet on the rail.

Even though the tenon is reduced in width due to the rabbet, this reduction in width must not be confused with the reduction due to relishing, to be explained fully later.

When the edge of the rail must finish flush with the end of the stile as is often the case, the tenon must be relished as shown in Figure 101. The length of the tenon is measured from the end of the tenon to the nearest shoulder. Notice also that the width of the tenon is measured from the face of the rabbet and not from the edge of the rail. The width of the tenon is influenced by the width of the rabbet and the amount of relish.

In Figure 102, the mortise in the stile is shown in its relation to the rabbet; one wall of the mortise must line up with one face of the rabbet.

In Figure 103, the stock is turned to show more clearly how the width of the rabbet effects the width of the tenon. The width of

(Continued on page 13A)

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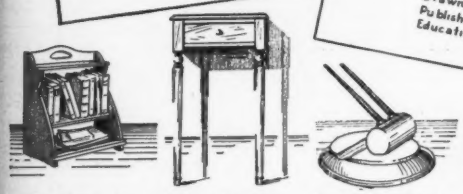

Project No. A-5 Magazine Stand | Project No. A-2 Bed Table | Project No. A-14 Pen Holder

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WRITE FOR NEW 1939 CATALOG

WALKER-TURNER *Engineered* POWER TOOLS

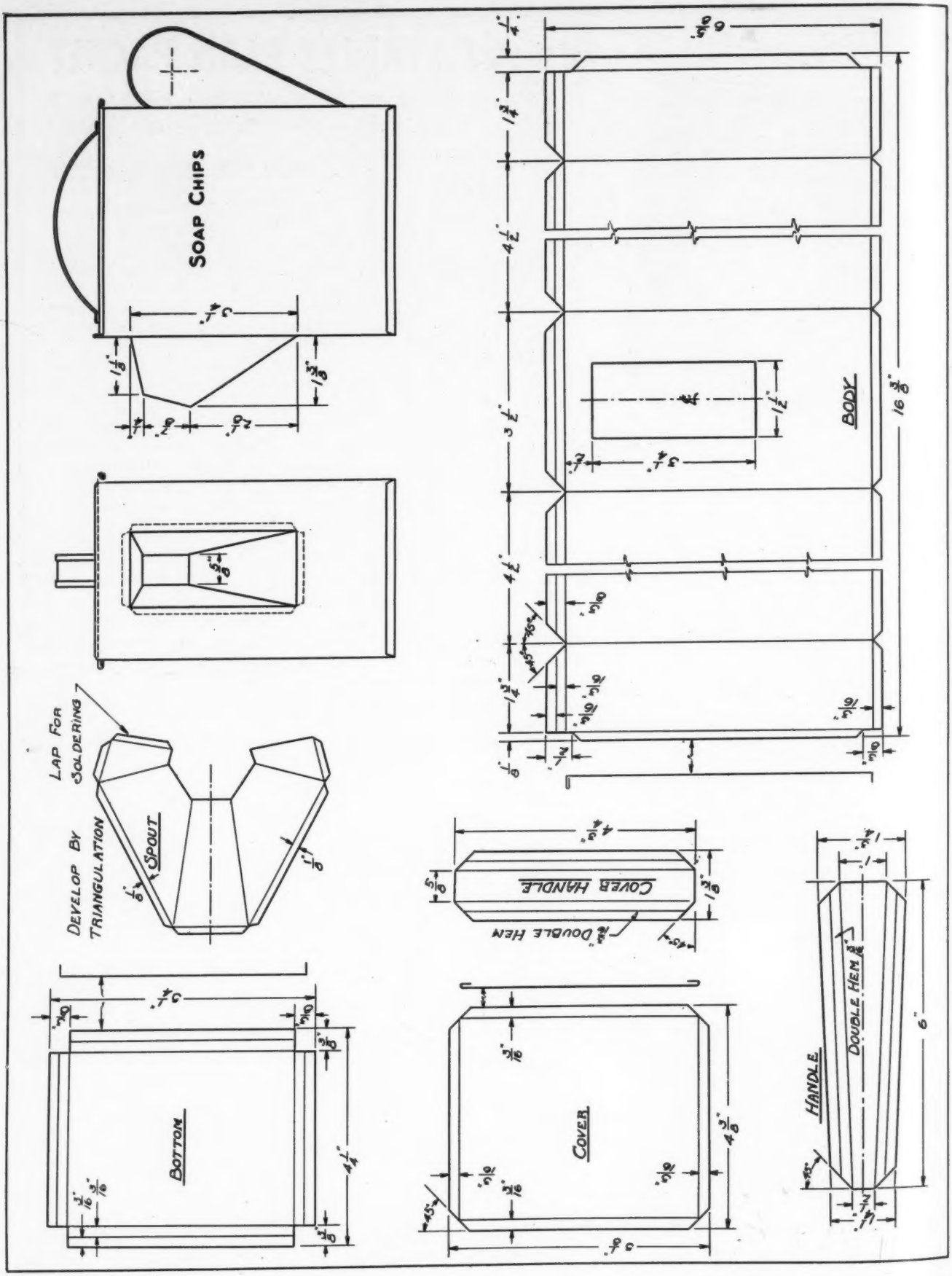

Fig. 3. Details of soap container

(Continued from page 86)

the tenon is measured from the face of the rabbet to the relish.

When entering the notes on a cutting bill, this variety of tenon should be specified as follows: t by w by 1 in., relished — shoulders offset x in. — rail rabbeted, see detail.

Example of cutting bill for rails of panel frame shown in Figure 104.

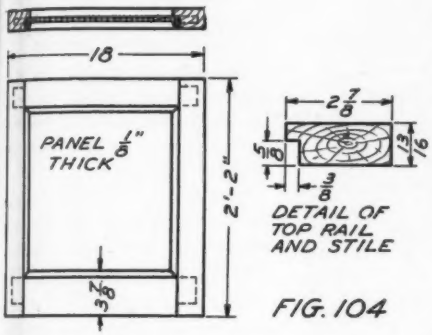

FIG. 104

Top rail — 1 piece 13/16 by 2⅞ by 16 in., tenoned two ends 5/16 by 2 by 1½ in., relished. Shoulders offset ⅜ in. Rail rabbeted ⅝ in. wide by ⅜ in. deep.

Bottom rail — 1 piece 13/16 by 3⅞ by 16 in., tenoned two ends 5/16 by 3 by 1½ in., relished, shoulders offset ⅜ in. Rail rabbeted ⅝ in. wide by ⅜ in. deep.

(To be continued)

SOAP CONTAINER

Harry W. Kroll, Senior High School, Rockford, Illinois

General Directions

1. Go over the drawing and model carefully to understand the construction of this project.
2. Read the job sheet to note whether any new operations are involved in this project.
3. When demonstrations are given, ask questions if in doubt about any part of the construction of the project.
4. Make a trial sample of a joint or construction which is new, in order that it may be more clearly understood when worked out on the project.
5. Go over the drawing and note the number of pieces required and the dimensions of each piece.
6. Cut out all the material for the project after completing step No. 5.

Material: 1c or 1x tin plate.

Body

1. Examine the cutting on the body in order that the folding may be done more accurately.
2. Cut as much of the spout opening with a tin snip as is possible. Cut the remainder with a cold chisel.
3. Fold the two ends of the body for the grooved seam. Determine carefully the amount which is to be used for each fold, and the direction in which each is turned.
4. Now fold a single hem, closed lock, on the upper edge of the body.
5. In the vise, bend the 3/16-in. single hem just completed, to a right angle with the body. Do not fold the 3/16-in. hem on the front or spout side of the body. Figure 1 shows the direction of the fold.
6. Now fold the 3/16-in. allowance at the bottom to a right angle with the body. Figure 1 shows the direction of folding.
7. Bend the body at the corners to the proper shape. Have the 3/16-in. folded edges on the outside of the body. Hook the ends together for the grooved seam, and complete with a hand groover.

Spout

1. Bend the spout at the proper corners and solder the lap joint.
2. The ⅛-in. allowance on the spout which fits into the body, is now bent to an angle suitable for a tight-fitting joint when the spout is slipped into position in the body.
3. Solder the spout in place, sweating the solder well under the joint on the inside of the body. Adjust the spout to fit accurately.

Bottom

1. In the bar folder bend up 3/16-in. material to a right angle on all four edges.
2. Place the body down onto the bottom piece and set down the 3/16-in. upright fold of the bottom piece. Complete the seam on the stake and then dress the seam carefully.
3. Solder the bottom on the inside of the body.

Cover

1. Fold with a closed lock the 3/16-in. single hem on all edges of the cover. Before pressing down this hem, slip a piece of No. 20 sheet iron in the long sides of the cover, and at one end. Now press down the hem. This will allow for the sliding of the cover onto the body. Figure 2 shows a section of the cover when in place. Adjust the cover to slide easily.
2. Form the cover handle by folding the 3/16-in. double hem on each edge and roll to shape. With pliers bend each end slightly for a good soldering joint. Solder in place.

Body Handle

1. With a closed lock fold the 3/16-in. double hem on the two edges of the handle.
2. In the forming rolls, shape the end of the handle as shown on the drawing.
3. Solder the handle securely.

Finish

1. Clean the entire project well.
2. Enamel it in some suitable color appropriate for use in a kitchen.

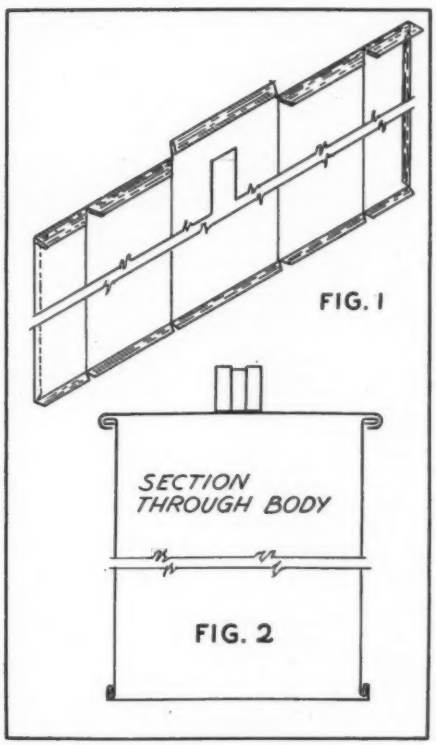

FIG. 1

FIG. 2

Fig. 3. Details of soap container

Personal News

• Mr. V. L. Pickens, supervisor of industrial arts at Kansas City, Mo., was guest instructor last summer in the Department of Industrial Education, at the Colorado College of Education, Greeley, and at the Kansas Teaches' College, in Pittsburg.

• Dr. Warren K. Layton, Detroit, Mich., has been named to a committee to undertake the establishment of a new division of occupational research and guidance in the U. S. Office of Education.

• The staff of the Copernicus Junior High School, Hamtramck, Mich., has been increased by the addition of Mr. Theodore Stover as instructor in machine-shop practice.

• Dr. William E. Warner of the Ohio State University, Columbus, was the principal speaker before the Arizona Education Association and the Arizona Vocational Association on December 2, 1938, at which time he made the following five addresses: *The Modern School Becomes a Laboratory for Living*, before the general session of the Convention; *A Criterion Characterization and Appraisal with Examples of the Modern Program in Industrial-Arts and Industrial-Vocational Education*, before the Administrative Session; *Ten Years of Progress in Industrial-Arts Education*, before the industrial-arts luncheon; *The Prescription and Presentation of Our Ultimate Programs*, before the combined vocational sessions; and *Research or the Scholarship of the Practical-Arts and Vocational-Education Teacher*, at the concluding banquet.

New Publications

Architectural Drawing for High Schools

By Harvey W. Waffle. Cloth, 324 pages, 7¼ by 10¼, illustrated. Price, $2.75. Published by The Bruce Publishing Company, Milwaukee, Wis.

This book is intended to give high-school students a well-laid foundation in architectural drawing. The four leading types of house construction — frame, stucco, brick, and stone — are all included and quite thoroughly explained.

The material in this course has been tried out in the author's classes for several years and has been found to be excellently adapted for the purpose for which it was prepared.

It is very flexible and contains enough material for four semesters of work.

Practical and Theoretical Photography

By Julian M. Blair. Cloth, 237 pages, 5¼ by 7¾, illustrated. Price, $2. Published by the Pitman Publishing Corporation, New York City.

This book, written by one who has taught photography for many years, contains much that is extremely helpful as well as very interesting to the amateur photographer.

The book contains 29 chapters devoted to cameras and developers, films, contact printing, enlarging, making exposures, infra-red and color photography, portraiture, X-rays, lenses, intensification, reduction, lantern slides, photomicrographs, natural-color photography, toning, retouching, night photography, silhouettes, police and news photography, photoengraving, stereoscopic pictures, composition, density, developing, fixing, washing, silver halide crystals and the latent image, and an appendix containing many types of chemical formulas.

Part 2 is entitled *Teaching with the Motion Picture and Other Visual Aids* in elementary, junior, and senior high schools, and in adult and higher education.

Part 3, *Selecting Instructional Materials.*

(Continued on page 14A)

The SEBASTIAN TIMKEN GEARED HEAD LATHE UNSURPASSED for SAFETY and EASE of OPERATION

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The lever operating the control switch has the safety feature of preventing the student operator from carelessly throwing from forward to reverse.

The larger motors furnished with these lathes assure more power and longer life.

The Sebastian Lathe Company, Cincinnati, Ohio

(Continued from page 13A)

Part 4, *Film Production in Schools.*

Part 5, *Experimental Research in Instructional Films.*

Part 6, *Teacher Preparation in Visual Education.*

An appendix containing a bibliography has been added.

Elementary Practical Mechanics

By J. M. Jameson and Charles Wilbur Banks. Cloth, 363 pages, 5¾ by 8¾, illustrated. Price, $2.75. Published by John Wiley and Sons, Inc., New York City.

This is a fourth revision and enlargement of this well-known book which was specially designed for students of technical and engineering schools who need a text that is more complete than the material commonly furnished in books on general physics.

The book contains a large number of very interesting and practical problems. Some of the material has been rearranged in this edition so that it will be more convenient both for the teacher and the student.

Association News

♦ The St. Louis meeting of the new National Association of Industrial Teacher-Trainers was a marked success in view of attendance and of program.

Speakers at the special sessions of this group were: Myers, Michigan; Tiffen, Purdue; Murtland, Michigan; Emerson, Cornell; M. Norcross Stratton, Assistant State Director of Vocational Education for Massachusetts. In the absence of Professor Jackey, Dr. Fryklund of Wayne University reported for the Research Committee, comprised of Fryklund, Jackey, and Struck. The Teacher-Trainers and State Supervisors in Industrial Education held a joint luncheon with Dr. Myers as speaker.

The membership now totals 200 in this group affiliated with the AVA.

Officers for the coming year are as follows: President, V. P. McKinley, University of Alabama; secretary-treasurer, Homer J. Smith, University of Minnesota; vice-presidents, David F. Jackey, University of California at Los Angeles, Verne C. Fryklund, Wayne University, E. L. Williams, Texas Agricultural and Mechanical College; trustees, Helen Livingston, New York State Department of Education, Arthur B. Mays, University of Illinois, F. Theodore Struck, Pennsylvania State College.—*Homer J. Smith.*

♦ Consumer educators have now organized a Consumer Education Association composed of teachers in elementary schools, secondary schools, junior colleges, and senior colleges.

The purposes of this association are:

1. To discuss the problems of consumer education:

a) What ought to be the aims and objectives of such a course?

b) What ought be the course content?

c) Ought the course be *vocational* in the sense that it teaches people to buy specific things wisely or ought it be *nonvocational* in the sense that it discusses general problems such as housing, advertising, etc.?

d) Ought it be a one-year course or a half-year course?

e) What contributions ought we encourage other high-school departments to make?

2. To develop a central bureau to collect information, source material, research material, etc., for the entire group.

3. To conduct original researches on a national scale.

4. To list factories and schools open for study by our members.

5. To interchange problems of methodology.

6. To contact research organizations and publications to obtain special rates for workers in this field.

7. To initiate and develop a consumer-education journal.

8. To become a force for the greater welfare of our young and adult consumers in American life.

Dr. John M. Cassels, Director of the Institute for Consumer Education has offered us the services of his Institute for securing source material and will aid our organization in developing materials and a methodology for consumer-education courses. The address of the Consumer Education Association is 45 Sunnyside Avenue, Brooklyn, N. Y.

♦ The annual meeting of the Ohio Vocational Association of Trades and Industries was held in Columbus on December 28. Mr. John F. Locke, Cincinnati, acted as chairman. At the general session, Mr. J. H. Mason, Canton, discussed *Canton's New Venture in Vocational Education,* and Mr. Thomas H. Quigley, Atlanta, Ga., talked on *Vocational Education in the United States.*

A number of departmental meetings were held, with discussions on a variety of subjects, including metalwork, printing, patternmaking, auto mechanics, electricity, and girls' vocational work.

♦ The Metropolitan Industrial-Arts Round Table, in the Chicago and suburban areas will hold its regular meeting on February 17, in the Maine Township High School, Des Plaines, Ill.

♦ The Western Arts Association will hold its next meeting May 3–6, 1939, in Grand Rapids, Mich. The convention theme, "The Arts in America Today," will place new emphasis on "Radio and the Movie as Dynamic Art Forms"; "Arts in Relation to Youth"; and on "Living American Artists."

Mr. Edwin Ziegfeld, Minneapolis, will act as program chairman, and will be assisted by an able group of coworkers.

♦ The Massachusetts Conference on Industrial Arts held a two-day meeting on October 21 and 22, 1938, in Fitchburg. The conference was attended by 250 industrial-arts instructors.

The following addresses were made: *Unit Organization of Industrial Arts in Junior and Senior High Schools,* Dr. Roy O. Billett, Boston University, Boston, Mass.; *The Nature and Scope*

(Continued on page 17A)

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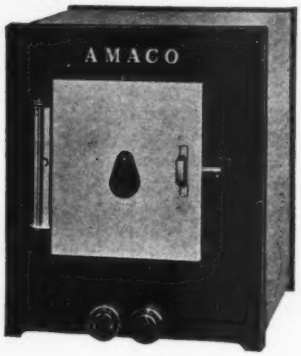

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HIGGINS

(Continued from page 14A)

of Industrial Arts in the American Program of Education, Dr. William E. Warner, Ohio State University, Columbus, Ohio. Mr. Robert O. Small, Director, Division of Vocational Education, Commonwealth of Massachusetts, spoke on the subject of vocational training, while Mr. Patrick J. Sullivan, Director, Elementary and Secondary Education and State Teachers Colleges, Commonwealth of Massachusetts, spoke on the subject of industrial arts.

♦ At the regular fall regional meetings of the Washington Industrial-Education Association, the following new officers were elected for the next year: H. G. Halstead, Seattle, president; Gordon C. Smith, Seattle, secretary; and Mr. C. T. Miller, Tacoma, vice-president.

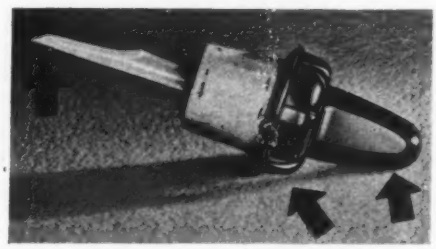
♦ The third annual conference of the New England Industrial Arts Teachers Association was held on Friday and Saturday, November 4 and 5, 1938, in New Haven, Conn. The conference was well attended by superintendents of schools, and principals of junior and senior high schools. Each of the New England States was represented among the 250 who attended.

The officers elected for the coming year are as follows: President, Morris P. Cates, Portland, Me.; first vice-president, John Cave, Hamden, Conn.; second vice-presidents, Lawrence B. Cobb, South Portland, Me., Harvey H. Wheaton, Concord, Mass., Arthur J. Martin, Montpelier, Vt., C. J. Powers, Dalton, Mass., Everett Childs, Pawtucket, R. I., Fred Martin, Bridgeport, Conn.; secretary, Willis B. Anthony, Fitchburg, Mass.; treasurer, Dana C. Cummings, Brewer, Me.— *Willis B. Anthony.*

♦ Wichita, Kans., Toledo, Ohio, Obion County, Tenn., and Box Elder County, Utah, have accepted the invitation of their respective state departments of education to co-operate with the Office of Education, Department of the Interior, as demonstration centers for community programs in home and family life education in the United States — the beginning of a program that is expected to develop into one of national significance.

New Products

THE CHARLES M. HIGGINS COMPANY, 271 Ninth St., Brooklyn, N. Y., is offering a new, improved quill stopper for use with the famous Higgins American Drawing Ink Bottle.



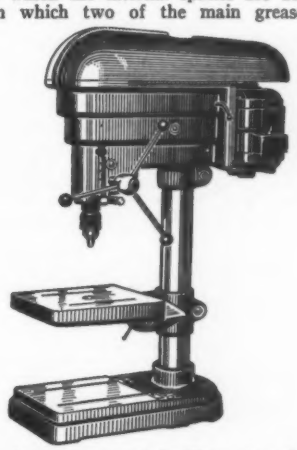
The ridges prevent the stopper from rolling when placed on a sloping drawing table. The stopper is weighted so that it rests with the quill up. The flat side on the steeple provides a thumb rest, makes it easy to grip, and places the open face of the quill uppermost when the thumb is on the flat side.

Complete information is available upon request to the Charles M. Higgins Company.

IN ADDITION TO THEIR PRESENT LINE of light-duty drills, the Boice-Crane Company, Toledo, Ohio, is offering a new line of medium-duty drill presses in standard bench and floor models, with slotted, or oil-trough machine-shop-type table; also 2- and 4-spindle multiples for bench mounting. Foot feed, and high-speed tapping attachments are also available.

This new drill-press line features a new 6-tooth spline drive, with teeth of the new involute type. The convex tooth sides of the involute-type tooth give more driving power because of their larger contact surface. The same feature also increases the smooth running qualities of the spindle at high speeds, as the driving force of the convex spline teeth is toward the center of the spindle rather than tangent to its circumference.

Another new feature of improved mechanical design is the steel driving sleeving of large diameter in which the internal splines are broached, and on which two of the main grease-sealed



ball bearings are mounted. These two bearings are larger than commonly used on drill presses of this size and capacity. Two more grease-sealed ball bearings complete the mounting of the spindle, a total of four ball bearings. Bearing seats of the latter two bearings are spaced extra wide to increase spindle support.

(Continued on page 19A)

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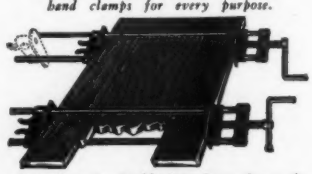

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(Continued from page 17A)

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New Trade Catalogs

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THE WALKER-TURNER COMPANY, INC., Plainfield, N. J., has announced its new Catalog G-9, which is devoted to descriptions and illustrations of a wide variety of power tools and accessories.

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THE CHICAGO WHEEL & MANUFACTURING COMPANY, Chicago, Ill., has issued its new catalog of 61 pages, entitled *Handee Tool of 1001 Uses.* The Handee grinds, drills, cuts, carves, sands, saws, and sharpens. It may be used to work on a practically limitless variety of material — metal, wood, bone, stone, glass, resin, and composition materials, etc., with 200 accessories.

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Trade News

Farm Mechanics in the School is the title of a new book, published by the South Bend Lathe Works, South Bend, Ind. This new book contains much practical information on the instruction of farm mechanics in schools. It shows methods for organizing a farm-mechanics shop, suggests the classification of projects, tells how to plan a farm shop, recommends types of equipment for the shop, and suggests a number of floor plans and layouts for various sizes and types of shops. The booklet is illustrated with photographs of actual farm shops and shows various types of work which can be handled in them. It is available free of charge upon request to the South Bend Lathe Works.

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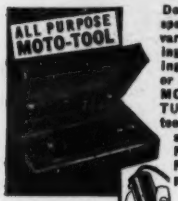

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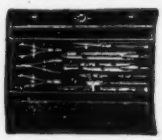

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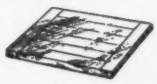

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